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A SYMPOSIUM ON RENAL INFECTIONS[1]

HUGH CABOT, M.D., F.A.C.S.
GEORGE GRAY WARD, JR., M.D., F.A.C.S.
J. BENTLEY SQUIER, M.D., F.A.C.S.
FRED J. TAUSSIG, M.D., F.A.C.S.
ARTHUR H. CURTIS, M.D., F.A.C.S.
ARTHUR L. CHUTE, M.D., F.A.C.S.

ERRORS IN DIAGNOSIS OF RENAL AND URETERAL CALCULUS

BY HUGH CABOT, M.D., F.A.C.S., BOSTON

Assistant Professor, Genito-Urinary Surgery, Harvard Medical School; Chief of Genito-Urinary Department, Massachusetts General Hospital

ANY attempt to estimate the nature or frequency of errors in the diagnosis of stone in the kidney and ureter is handicapped at the outset by the well-known fact that only a small proportion of the errors are either entered upon the record or reported. We may, therefore, take it for granted that in any review of cases such as I am about to undertake we shall grossly underestimate the frequency of error, though we are more likely to approximate the various kinds of traps set for the unwary.

In a recently undertaken study of 153 cases of stone in the kidney and ureter at the Massachusetts General Hospital, it was noted that 26 abdominal operations had been done upon these patients without relief of the symptoms, which were clearly due to the overlooked calculus in kidney or ureter. The appendix was the most frequent sufferer and was removed in 10 cases, without benefit. What are described as exploratory laparotomies came next in frequency, with 8 cases. Fixations of a kidney supposed to be movable and producing symptoms followed in order with 4. Then came removal of tube and ovary, unsuccessful search for gall-stones, an attempt to relieve adhesions which did not exist, stripping of the capsule of the kidney for nephralgia, and, as a crowning iniquity, suprapubic cystotomy on a normal bladder for a stone which was situated some two feet away. Each of these monumental blunders has one representative.

Since these errors occurred in the hands of reasonably competent surgeons, it is interesting to discover what symptoms led to the false conclusion. In a study of this group of cases, it appears that in 12 pain in the right lower quadrant constituted what may be called the presenting symptom, the one for which the patient had sought advice and finally came to the hospital. Abdominal pain entirely without colic was the presenting symptom in 13, while backache was the chief complaint in 11. In all this group of 35 cases, the pain was never such as to suggest stone in the kidney and could readily have been mistaken for that associated with disease of abdominal viscera. If, therefore, pain is relied upon as important evidence of stone it is likely to be highly misleading.

It has been generally believed that such errors could be avoided by the routine ex-

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amination of the urine, and that only in a small proportion of cases would stone in the kidney, producing pain over a considerable period of time, be associated with a normal urine. Upon this point our study is illuminating. In 150 cases in which the urine was carefully examined on more than one occasion, there were 21 in which the urine was entirely normal, so that in 14 per cent of the cases reliance could not be placed upon this evidence. It further appeared that the probability of a normal urine was much greater with stone in the ureter than with stone in the kidney. Thus, in the 21 cases of normal urine, 15 were cases of stone in the ureter and 6 cases of stone in the kidney. It is, of course, particularly in cases of stone in the right ureter that the diagnosis of appendicitis is likely to be made.

Much reliance has been placed upon the X-ray in cases of abdominal pain of an obscure type, and it is interesting to inquire how frequently the X-ray fails to detect stone. In 127 cases in which satisfactory X-rays were obtained, 8 were entirely and persistently negative, which represents a failure of 6 per cent. This is, I believe, considerably short of the real percentage of failure, because in many of these cases X-rays were repeatedly taken over a period of weeks or months, and if a positive plate was finally obtained, sight of the negative ones is entirely lost. I am inclined to think that 15 per cent is nearer the percentage of failures, even in the hands of thoroughly expert radiologists.

From this it appears that we cannot rely upon the character of the pain, the abnormality of the urine, or the positive evidence of the X-ray to lead us with certainty to diagnosis. Further analysis of the cases, however, shows that in this rather small group there was no one in which all these three suggestive symptoms or signs were absent at the same time; and I believe that it would be fairly safe to assume that the absence of characteristic colic, a normal urine, and a negative X-ray is a combination of extreme rarity.

There was another group of wrong diagnoses which should be credited to the physician rather than to the surgeon. These included ulcer of the stomach, lumbago, sacro-iliac strain, acute and chronic Bright's disease, chronic cystitis, and neurasthenia. In support of these errors the following mitigating facts may be noted:

Pain referred to the stomach and vomiting was the chief complaint in 3 cases in the series of 153, sacro-iliac pain and pain called lumbago was the important symptom in 3 cases, while pain referred to the bladder, without other symptoms, was present in 7.

There are a considerable number of cases, though I have no accurate figures, in which abnormal urine is the only abnormality to be found. In these a diagnosis of Bright's disease is distressingly common, apparently predicated upon the fact that the urine contains albumin and either pus or blood. It seems almost superfluous to point out that there is nothing about these patients other than the urine to suggest Bright's disease, and that such a diagnosis could not be made by a physician who recognized the fact that chronic nephritis is a disease which affects the cardiovascular system as well as the kidney.

We see every year with our colleagues in the Orthopedic Department a considerable number of cases with pain referred to the region of the sacro-iliac joint, and of these a considerable number prove to have stone in kidney or ureter. Error here can almost invariably be avoided by an examination of the urine and a careful examination of the X-ray plates, which are usually taken in the course of diagnosis of the orthopedic difficulty.

It should not be necessary at this time to point out to any trained physician that bladder irritability and an abnormal urine may be the sole symptom of stone in the kidney.

The unfortunate patients who are declared neurasthenic have, in our series, been those with abdominal pain, negative physical examination, and a normal urine. In our series two such patients had stones in the ureter, the removal of which cured the neurasthenia.

Having thus reviewed the cases in which a wrong diagnosis of some other disease resulted from the overlooking of stone, I was interested to turn the tables around and look over some 300 records during a period of 10 years

in the Out-Patient Department in which a provisional diagnosis of renal calculus had been made. In this 300, 65 had to be subsequently corrected, as careful further study showed no stone. In these 65 cases in which no stone was found, on further study 28 were finally proved to have some of the following conditions: Orthopedic difficulties, including abnormalities of the spine, sacro-iliac joint, and faulty attitude, accounted for 9; disease of the kidney or urinary system was proved in 9; calcified tuberculous glands for 4; gall-stones for 2; and the rest were scattered among pelvic peritonitis, chronic appendicitis, constipation, and neuroses.

To the trained urologist the most interesting man-traps are those set for him by his association with the imaginative radiologist. Of the cases coming to us with symptoms referable to the kidney, and often with more or less typical renal colic, a considerable number are reported as showing shadows in the course of the urinary tract which, according to the temper of our expert brother, are said to be probably calculi or probably not calculi. As far as I can determine, the probability depends largely upon whether he has recently been mistaken on the positive or negative side. A burnt child fears the fire, but as the radiologist is situated between two fires he may take refuge in either, to the confusion of the urologist. The difficulties of absolutely confirming the diagnosis in presence of doubtful shadows are considerable. Thus, calcified tuberculous glands lying in the mesentery of the large intestine may be in immediate contact with almost any portion of the kidney or upper ureter. They may even go so far as to press upon the ureter and obstruct it. I have knowledge of two cases at least in which a calcified tuberculous gland produced great obstruction of the ureter with dilatation. In one case the gland was situated in the pelvis and in the other in the midlumbar region. That these cases are fortunately rare should be a source of congratulation. Most foreign bodies in the urinary tract may be verified by the use of radiograph catheters and stereoscopic plates. This method will generally enable one to decide that the suspected shadow is at some distance in front of or behind the kidney or ureter. In the cases where the shadow lies in contact with the ureter catheter, but does not produce obstruction to the catheter, a correct opinion may be arrived at either by demonstrating that the ureter is dilated by the use of an injected radiograph or by the wax-tipped catheter. Neither of these methods, however, will solve the problem in the few cases above referred to in which the passage of the catheter is obstructed by pressure from without. Under such conditions the wisdom of attempting to make an injected radiograph may be doubted, as, should the injecting fluid pass through the stricture under urging from below, it may well fail to return as easily, and in most cases the injected fluid will not pass the stricture. It is probable that in most of such instances operation is indicated, as was the case in the two above referred to; but there are probably some in which, though the passage of a catheter is interfered with, the passage of the urine is not, and therefore operation must be regarded as meddlesome. Under these circumstances, a decision will have to be made on the evidence of the symptoms. If they suggest ureteral obstruction, if the catheter will not pass and it is not thought wise to force fluid by, operation should be undertaken.

There is a small group of cases which have seemed to me particularly troublesome. It consists of patients who have symptoms suggesting stone in the ureter, a normal urine, a shadow which may be in the lower end of the ureter, and a ureteral orifice into which a catheter will not enter. In two such cases I have fallen into the trap thus neatly constructed. In one I concurred with my colleague, Dr. Smith, in advising operation upon a young man with shadows in the region of the lower end of both ureters, neither of which could be catheterized, with colic upon both sides, and a normal urine. Operation showed both ureters free from obstruction, and he made a very eventful and stormy convalescence. In the other I repeated the same blunder myself, only the obstruction existed upon but one side and the orifice of the ureter proved to have a stenosis.

That there are many other pitfalls which beset this complicated question I have no doubt, but these are the ones which have been presented to us in the study of this group of cases. At present I am inclined to lay down the following rules as likely to avoid these errors if carefully followed:

1. In all cases of abdominal pain of a chronic or recurring type, in cases of backache, lumbar or sacro-iliac joint strain and lumbago, careful repeated examinations of the urine, including a microscopic examination of the sediment in all cases whether albumin is present or not, and of a catheter specimen in all female patients, should precede positive diagnosis. In most of these cases in which the symptoms warrant the consideration of operation, X-ray plates are essential.

2. The evidence presented by the X-ray alone is insufficient to warrant operation in most cases of stone in the kidney or ureter. Possibility of error by mistaking other foreign bodies should be excluded by the use of the ureter catheter, stereoscopic plates, injected radiograph, or the wax-tipped catheter.

3. In any case in which the symptoms suggest ureteral calculus and a doubtful shadow appears in the X-ray plate, if the ureter cannot be catheterized on repeated attempts or the catheter is arrested at the same point on various occasions, the decision for or against operation must be made upon the apparent gravity of the symptoms.

4. In cases with symptoms suggesting stone in the kidney, with a normal urine, a negative X-ray, and an unobstructed ureter, the wax-tipped catheter will not infrequently lead to a correct diagnosis and will be likely to fail only in the cases in which the stone lies in a dilated calix and is therefore out of reach of the catheter.

POST-OPERATIVE RENAL INFECTION

By GEORGE GRAY WARD, Jr., M.D., F.A.C.S., New York

I BELIEVE that many instances of obscure and apparently unaccountable elevations in temperature, with concomitant symptoms of septic absorption occurring late in the course of a post-operative convalescence, are cases of renal infection, and that they are much more frequent than we formerly believed. In the majority of cases these renal infections are of hæmatogenous origin, and are due to the colon bacillus.

In 1906, Brewer first described as a distinct entity a type of acute hæmatogenous infection of the kidney which was unilateral and characterized by multiple septic infarcts. Since this publication numerous cases of this type of infection have been reported by a number of observers, and further contributions by Brewer, Cobb, and others have helped to clarify the subject, and have enabled us to classify its variations and to aid our understanding of its pathology and symptomatology.

But the indications for the treatment of the severe types of this disease are by no means well defined. Neither is the question settled as to whether this type of kidney infection is characterized by being unilateral, as claimed by Brewer. There would seem to be no reason why the infection might not attack both kidneys simultaneously in certain instances, or first one organ and then the other. Thus it might be possible to account for the variations in the results of nephrectomy and nephrotomy, or decapsulation. As Kelly and Burnham state, the subject deserves more study and careful recording of cases; hence my excuse for this report.

In studying the reports of cases of this disease, one is struck with the frequency with which it follows some operative procedure. This is not strange when we remember the probable causative factors and the mode of infection. The preponderance of evidence — the result of both clinical and experimental research — tends to prove that the large majority of such renal infections are hæmatogenous in origin, although some cases may be caused by an ascending infection either by way of the peri-ureteral lymphatics, or by extension up the lumen of the ureter.

Albarran first demonstrated that pus-producing organisms gaining access to the blood were eliminated through the kidneys and that these organs were not necessarily damaged as a result. Numerous observers have confirmed these results, and have shown further that anything tending to lower the vitality of the kidney would cause the lodgment of the micro-organisms in the substance of the organ with resulting infection.

Lannelongue first noticed that some fatal cases of osteomyelitis have an associated septic infection of the kidney, and Israel and Jordan showed that comparatively insignificant local infections, as furuncles, etc., might be the origin of a septic kidney, just as, by metastasis, they may be the cause of a septic joint. Consequently, whenever we have an infection following operation, be it ever so mild or insignificant (as, for instance, a small stitch-abscess in the skin incision), should one or both kidneys happen to be damaged by previous disease such as might be caused by a calculus or some form of nephritis or by anything that produces congestion and prevents free drainage of the organ (as excessive mobility), the kidney may become infected on account of its lowered resistance from the bacteria which are being filtered through it, with the resulting formation of multiple septic infarcts.

Furniss states that in his opinion most of these cases are due to the breaking loose of infected thrombi from the vessels of the wound region, and that they find lodgment in the kidney where they develop the infection. The fact that this condition develops some days after the operation and is sudden in onset and that there usually has been some manifestation of post-operative infection, points to the correctness of this theory.

The greater frequency of infection of the right kidney is probably due to its greater mobility and its more frequent displacement, the drainage from that organ being less perfect in such cases, owing to kinking or looping of the ureter. Cotton reports two cases occurring in floating kidneys which were markedly displaced. The extreme vascularity of the kidney predisposes it to congestion, especially if displaced, and this disturbance in its circulation interfering with its function is an important predisposing factor in the production of its infection.

The preponderance of cases in females has been noted often, and is due probably to the fact that floating kidney is more common in that sex. Cotton also points out that the operation of decapsulation and drainage not only relieves the infection, but results in fixation of the kidney, and thus corrects the prolapse, which may have been a factor in the etiology.

Baisch states that while other bacteria may be the original factor in the production of the primary infection, they are supplanted by the colon bacillus; or that, if a mixed infection is present, the colon bacillus persists after the others have disappeared.

The common association of this disease with operations upon the intestinal tract, as for appendicitis, may account for the frequency of colon bacillus infections. Anything that causes a lowered resistance of the kidney makes it a suitable soil for the infection which is constantly passing through it by way of the urine, whenever infection is present in some part of the body. Undoubtedly the pyelitis of pregnancy and the puerperium is but a phase of these cases of kidney infection. The condition of pregnancy predisposes to the attack on account of the pressure by the gravid uterus on the blood-vessels and ureters, causing an increased congestion and less perfect drainage of the kidneys; and the ever present colon bacillus in the neighborhood of the parturient canal and the frequency of parturient wounds supplies the primary focus of infection.

There are three types of the infection, depending upon the degree of virulence, and the virulence naturally varies according to the particular organism, the condition of the kidney, and the general bodily resistance of the patient. They are —

1. Cases which are mild in character, the patient not being severely ill, which yield to the thorough flushing of the kidneys by the ingestion of water and formaldehyde, and which yield to proper diet and rest.

2. Cases in which the kidneys contain numerous septic infarcts, and minute or

microscopic pus-foci, which are superficially situated in the cortex of the organ. Decapsulation or incision with drainage usually results in recovery.

3. The fulminating type, which is characterized by a profound toxæmia, and which is rapidly fatal unless a nephrectomy is done. Fortunately this type of the disease is usually unilateral.

The staphylococcus and streptococcus infections produce an abscess formation which originates in a terminal vessel in the cortex as a single focus. From this primary focus other portions of the kidney become involved secondarily. As might be expected this type of the disease is the more severe. The colon bacillus produces a diffuse inflammation of the kidney which does not necessarily result in abscess formation or destruction of tissue. The kidney is enlarged, markedly congested, and infarcts are present. Microscopic examination of these areas of kidney-tissue may show the cells riddled with colon bacilli. This type of infection is less virulent than the former, and is frequently cured without sacrificing the organ.

As Cunningham has pointed out, a careful study of the clinical picture should show which of these two types is being dealt with, as the clinical signs differ in certain respects, and each has a definite relation to these two pathological conditions. He states that the symptoms should suggest the pathological process present, and that the type of infection should be recognized on inspection of the kidney at the operation. This is extremely important, as the form of procedure to be followed depends upon a correct diagnosis of the variety of the infection. Nephrectomy will be necessary in multiple abscess formation, while a nephrotomy or decapsulation with drainage may be sufficient in the milder forms. Nephrectomy is probably resorted to more frequently than is necessary, owing to a failure to appreciate the exact pathology. Cunningham states that the chief feature differentiating the mild form of the disease from that of abscess formation, is the lesser degree of progressive toxæmia, and the presence of more abnormal elements in the urine. He notes that the abscess cases are characterized by very slight changes in the urine, contrary to what one would expect. This is because the abscesses, being generally located in the periphery of the organ, find no avenue of escape through the collecting tubules, which are either plugged by the products of inflammation or compressed by the infiltrated tissue surrounding them.

As the less severe type of the disease is usually due to the colon bacillus, the presence of this organism in the urine gives rise to a characteristic appearance. The urine is turbid or cloudy, and remains so on standing. This is due to the motile power of the bacilli which keeps them in constant motion and thus prevents them from sinking to the bottom of the glass as other organisms do, with the exception of the proteus hauseri.

Urine containing the colon bacillus is nearly always of an acid reaction. Marked irritability of the bladder is present, due to the discharge of pus into the bladder. This irritability as manifested by frequency of micturition and dysuria is often an early sign of the onset of the disease, and I believe that many cases where the nurse has been held responsible for a supposed cystitis, due to carelessness in using the catheter, are really due to a renal infection of hæmatogenous origin.

In the treatment of mild cases of infection of the kidney the indication for conservatism is not disputable, and in the fulminating type with the presence of abscesses we have no choice but a prompt nephrectomy. But the proper treatment of the second type of the infection cannot be so clearly defined. Much depends on the progress of the disease in each individual case, and to decide correctly when to operate and when not to operate calls for the exercise of great care and thoroughness in considering all the factors, and sound judgment in weighing their relative value. The general principle governing the line of treatment should be that of conservatism coupled with a sharp watchfulness for signs and symptoms indicating that the point of toleration to toxic absorption has been reached by the patient, the result of lowered resistance caused by the progress of the disease.

At the outset, palliative measures such as

rest, a simple and unirritating diet, the ingestion of large quantities of pure water, with the employment of urotropin or other urinary antiseptics should be instituted and maintained so long as the resistance of the patient is equal to the task of combating the toxæmia. Should the limit of the patient's ability to resist the disease be approached, as shown by the blood count and a continued high range of temperature and increasing pulse rate with evident progressive loss of strength, operative interference is indicated.

It is important in employing urotropin to give a sufficient quantity to insure the presence of formaldehyde in the urine. As has been pointed out by Burnham, it is necessary to test the urine frequently for formaldehyde to be certain that it is being liberated. The usual dosage of five to ten grains three times daily is rarely sufficient, and it should be increased up to twenty or thirty grain doses if necessary to show the drug in the urine. As the antiseptic power of urotropin is not manifested in alkaline or neutral urines, the acidity should be assured by giving acid sodium phosphate.

If operation is necessary, nephrectomy should not be done unless the indications for it, as shown by the appearance of the kidney, are positive. A decapsulation or nephrotomy with drainage is sufficient in many cases, as shown by numerous reports, especially in the colon bacillus infections.

Lilienthal was probably the first to do a nephrotomy in a septic kidney. He reported a striking case of bilateral hæmatogenous infection with recovery following a double nephrotomy in 1896.

The following case of a severe colon bacillus infection which evidently first attacked one kidney and then the other, and in which decapsulation with drainage resulted in a complete recovery, is here reported.

Mrs. G. P., aged 42, was referred to me on October 29, 1914, by Dr. Kast, under whose care she had been for the previous year for treatment of a gastro-enterological condition, general enteroptosis, and neurasthenia. The patient from time to time had such symptoms as were indicative of fæcal stasis in the cæcum and ascending colon with a chronic appendicitis. In view of these recurring attacks of indigestion in spite of dietetic precautions, and in view of the tenderness in the appendix region, an operation was advised to remove the appendix in order to eliminate reflex disturbances which apparently originated from that organ.

Examination showed in addition to the above findings that she had a retroverted uterus of the third degree and a relaxed vaginal outlet.

I operated on October 30, 1914, doing a curettage, a repair of the pelvic floor, shortening of the round ligaments after the Gilliam method, and an appendectomy. The colon was dilated and relaxed, and a well-developed Jackson's membrane was present. There was no evidence of a Lane's kink. The appendix was adherent and showed a chronic inflammatory process.

There was nothing unusual in the convalescence during the first week except that the patient suffered more from gas than usual and her temperature did not reach normal after her initial reaction but remained at 100° to 100.5° up to the sixth day. The wound was then dressed and had apparently healed by primary union. On the ninth day she complained of soreness in the lower angle of the incision, and as her temperature had reached 101.5° with a leucocytosis of 20,500 and a polynuclear percentage of 78, the wound was opened just above the symphisis and a considerable quantity of pus was liberated. The laboratory reported a mixed infection.

It was noticed that an irritability of the bladder manifested itself on the fourteenth day, causing her to void five or six times at night, with dysuria. This irritability continued in varying degree throughout the illness. On the evening of the nineteenth day she complained of a severe backache. The abdominal wound was dressed daily, and closed without trouble. On the twentieth day the patient was out of bed for a short while, as her temperature had reached normal.

On the twenty-first day after the operation her temperature suddenly rose to 103.5° per rectum with a pulse of 120. The next day, the twenty-second, she complained of pain in the left lumbar region, and examination showed decided tenderness at the site of the left kidney. There was also extreme irritability of the bladder. This exacerbation continued for five days, during which time she was treated with diluents and urotropin. The urine was turbid and acid and contained numerous pus-cells, with an abundance of colon bacilli. A blood culture showed no growth. The temperature gradually declined to normal on the sixth and seventh days after the onset of this attack, and as the exacerbation was over and as the patient's condition showed marked improvement, a speedy recovery was hoped for, although it was explained to the family that these attacks were likely to recur.

On the twenty-eighth day a second exacerbation commenced which lasted for six days and was much more severe than the first, the maximum temperature being 104.2° and the pulse 140.

The patient was very drowsy at times and had

rigors, and the picture presented was that of a very sick woman. The left kidney was painful and there was decided tenderness in the left costovertebral angle and rigidity of the upper abdomen. The right side was negative.

Dr. Peck was called in consultation on the sixth day of the second attack, and after a careful study of the case it was felt that an operation was not indicated at that time, although the patient was much prostrated, as the temperature and pulse were declining and it seemed probable the exacerbation was nearing its end. The wisdom of this advice was apparent during the next three days when the temperature remained normal, and as shown by subsequent events. On the third day of this normal period and on the thirty-sixth day after the operation, the patient suddenly developed severe pain in the *right* lumbar region which was aggravated by deep breathing. There was marked tenderness in the right costovertebral angle. Dysuria was also greatly increased. A specimen of urine obtained by Dr. Furniss from the right kidney had shown the presence of colon bacilli.

The next day the temperature started to rise and it was evident that she was in for a third attack. By the fourth day the temperature had reached 104.5° per rectum with a pulse of 160, and it was plainly manifest that the patient had reached the limit of her endurance owing to her prolonged illness.

Dr. Lilienthal saw her in consultation and an exploration was made with an aspirating needle but with a negative result. An exploration of the kidney was advised in spite of this, and the next morning, the fifth day of this third exacerbation, I explored the kidney under gas and oxygen anæsthesia. The temperature at the time of operation was 104.2° per rectum and the pulse 150. The perirenal fat was adherent to the organ and on delivering the kidney it was found to be swollen to nearly twice its normal size. It was markedly congested, being a dark bluish color with mottled areas. The kidney was completely decapsulated, the capsule being adherent, and several infarcts were in evidence, but there were no gross signs of pus present. Minute portions of the infarcts and kidney-tissue were removed for examination. Further search showed no evidence of perirenal or subdiaphragmatic pus-pockets. Gauze and rubber-tissue drainage was employed. The time of the operation was sixteen minutes and of the anæsthesia twenty minutes.

In twenty-four hours the temperature had dropped to 101.6° and the pulse to 96, and the whole picture showed a marked change for the better. As the patient was so very weak with a hæmoglobin below 60 and red cells of but 3,500,000 it was deemed wise to transfuse her in order to increase her resistance and thus facilitate her recovery. Therefore, the day following the operation she was given 275 ccm. of blood from a vigorous male donor, by the syringe method. This resulted in a decided improvement in the condition, and the patient went on to a normal recovery without further incident.

The temperature reached normal on the sixth day after the decapsulation and the forty-seventh day after the original operation.

The report of the pathologist, Dr. R. W. Taylor, of the Post-Graduate Hospital Laboratories, on the tissue removed from the kidney was as follows:

"December 10, 1914. Three pieces of bright red tissue, each having a volume about that of a split pea. Microscopic examination sections reveal indistinctly the structure of the cortical portion of the kidney, in which is a marked inflammatory reaction manifested by the diffuse infiltration of enormous numbers of polynuclear leucocytes. All of the recognizable tubules and glomeruli show a marked cloudy swelling, and in some areas where the leucocytes are especially numerous they are completely disintegrated.

"The leucocytes may be seen beneath Bowman's capsule in the glomeruli, within the convoluted tubules, and in the inter-tubular stroma. So extensive and diffuse is the process that it is impossible to say from a histological examination whether it extended from the pelvis or was hæmatogenous in origin. In places the inflammatory cells are so numerous as to suggest small abscess formation, or it would not be surprising if the whole area from which the specimen was taken would necrose. There has also been considerable recent hæmorrhage between these tubules.

"Stains for bacteria revealed the presence of short gram-negative bacilli which are especially numerous in some of the tubules. Morphologically, these bacteria resemble the colon bacillus.

"Diagnosis: Acute diffuse, purulent nephritis with hæmorrhage."

This case is typical of the second variety of renal infection previously mentioned, in which a virulent septic involvement of the kidney by the colon bacillus produces a diffuse inflammation of the tissues with the formation of infarcts, but which at the time of operation had not produced macroscopic abscesses, but in the light of the pathologist's report would probably ultimately have done so.

Undoubtedly this case would have terminated fatally if operation had been longer deferred, yet as the attack on the left kidney subsided without interference, it would seem that the delay was justified. The first two exacerbations were apparently confined to the left kidney, as there was no evidence of the involvement of the right kidney until the onset of the third attack, when all tenderness

of the left organ had subsided for several days.

The condition of the urine in this case pointed to the type of the disease of the kidney which was found at operation in accord with Cunningham's observation, as there was an abundance of purulent elements constantly present.

The pathological state of the kidney, there being an absence of a gross manifestation of pus, indicated that a nephrectomy was not necessary, as was proved by the fortunate outcome.

During the latter weeks of the disease, the irritability of the bladder was relieved by the use of an injection of 20 per cent argyrol after irrigation. Instillations of a small amount of 4 per cent novocaine solution also gave considerable relief. This irritability seemed dependent upon the presence of pus, which was variable in amount.

It seems clear that this case was of hæmatogenous origin and that the original focus of infection was the suppurating abdominal wound, although possibly the appendectomy may have been responsible. The condition of enteroptosis with ptosis of the kidneys would seem to have been the predisposing cause producing congestion of the organs, and imperfect drainage of urine thus preventing the safe passage of the infecting organisms through the kidneys during the process of excretion.

The following two cases were of the milder type of infection and did not require radical treatment:

Mrs. E. P., aged 25, was operated on by me for complete perineal tear and lacerated cervix, sustained in labor seven weeks previously. The uterus was punctured accidentally with the curette and was repaired through an anterior colpotomy incision. For seventeen days after her operation the patient ran a mild temperature varying from 99° to 100° F.

For the first nine days after operation it was necessary to catheterize the patient owing to her excessive nervous state. The patient's temperature had remained normal for a period of nine days and she was apparently recovered, when she had a pronounced chill and her temperature suddenly rose to 103.5°. This rise of temperature lasted for six days and reached 106° F. This exacerbation occurred thirty days after the operation. Her temperature then remained normal for eight days, after which a second exacerbation developed which was of much milder type than the preceding one, and lasted but four days, after which her temperature reached normal and remained so. There was marked irritability of the bladder prior to the onset of the first exacerbation which continued intermittently throughout the periods of temperature. The urine showed the presence of considerable pus and the colon bacillus was isolated by culture. The treatment consisted in combating symptoms and giving large amounts of water with urotropin. The patient made a good recovery and has since remained well.

It is to be remarked that the patient was catheterized for nine days following the operation and that she had a rise of temperature more than should be expected for seventeen days after operation. This, of course, indicated an infection.

Miss J. N., aged 34, was operated on by me for retroversion, endometritis, and chronic appendicitis. She gave a history of two attacks of appendicitis. She was curetted and the Gilliam operation of shortening the round ligaments and an appendectomy were done. She made an uneventful recovery apparently until the fourteenth day after operation, when she developed an irritability of her bladder, as shown by frequent and painful micturitions. On the seventeenth day after operation she developed a sudden rise of temperature which reached 104° F. This exacerbation lasted for nine days. The temperature then remained normal for a period of nine days when a second exacerbation developed which was milder in type but reached 103.5° F. This was of six days' duration, after which the temperature reached normal and remained so. There was considerable pus discovered in the urine and the colon bacillus was isolated.

The treatment in this case consisted of diluents and urotropin.

In conclusion I wish to call attention to the following points:

1. That post-operative renal infection is more frequent than has been formerly appreciated, owing to the fact that in many cases it is overlooked on account of the mild character of the infection, the severe types being comparatively rare.

2. That vesical irritability occurring after operation may be an important precursory sign of renal infection, and therefore should not necessarily be attributed to a cystitis caused by carelessness.

3. That a study of the urine will show the probable type of the disease present, and thus be a guide to the treatment.

4. That a careful study of the pathological condition of the kidney should be made at the operation in order that nephrectomy may be avoided if possible.

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RENAL PAIN: DIAGNOSTIC AND CLINICAL SIGNIFICANCE

BY J. BENTLEY SQUIER, M.D., F.A.C.S., NEW YORK CITY

PAIN occurring in any part of the body is a symptom of such striking prominence that if correctly interpreted it may be considered a cardinal diagnostic sign. The researches of Sherrington, Langley, and Head have contributed greatly to the mechanism and neurophysiology of pain production. It is not our purpose, however, to consider pain mechanism or any of the phenomena of pain production, but rather to confine our remarks to the clinical manifestations, topographical interpretation, and diagnostic possibilities. The variability of pain, both as to origin and radiation, and its changing character render the clinical interpretation of pain for diagnostic purposes one of extreme difficulty and with many possibilities for error. However, even with these limitations clearly before us, pain is a most instructive diagnostic sign and one of importance in the analysis of clinical symptoms of disease.

The work of Langley on the autonomic nerves and of MacKenzie on the visceromotor and viscerosensory reflexes has contributed greatly to the interpretation of the origin of pain, the sensitiveness of tissues, and the radiation of reflections of painful impulses. It has been well established that pain is due to stimulation of some portion of the cerebrospinal nervous system, and is manifested by being referred to the peripheral distribution of cerebrospinal sensory nerves in the external body-wall. As a corollary of this, pain is elicited only upon stimulation of structures supplied by the cerebrospinal nervous system. In addition, this hypothesis must explain pain when it results from irritation of the viscera. Visceral pain impulses are conducted along the efferent nerves of the autonomic system, which in turn act by stimulating the cerebrospinal nerves so that the phenomena of pain, hyperalgesia, and muscular contraction in the external body-wall are indirect evidences of painful stimulation initiated by afferent autonomic nerves from the viscera. In other words, when the viscera are the site of an irritative process there is conducted through the autonomic nerves or sympathetic system the impulses of visceral irritation. The stimulating effects of these on the cerebrospinal sensory nerves center in the cord, reflect the pain to the peripheral distribution of such nerves, and there is established a viscerosensory reflex. If the cord stimulation affects a contiguous motor center, then contraction of the skeletal muscles occurs, constituting a visceromotor reflex.

The due recognition of these factors concerned in the production of pain is of paramount importance in interpreting the diagnostic value of pain. Sherrington has demonstrated that the spinal nerves have a fairly constant and uniform distribution to the external body-wall and that definite body-areas or zones may be demarked. This fact was anticipated by Head under the caption of "Head zones," and was subsequently elaborated and confirmed by Campbell.

If one were to lay a silver dollar on the right side of the abdomen midway between the ninth costal cartilage and the umbilicus, it would cover a zone of great pain-producing capabilities. A portion of the renal pelvis and kidney, the duodenum, the pancreas, the

common duct, the cystic duct, and pylorus would be subjacent to it, and a pain-provoking stimulation of one or more of these various viscera might give rise to almost any type of localized or referred pain. The fact that the renal pelvis, the ureter, and the bladder are somewhat similar anatomically to the gall-bladder, the common duct, and the duodenum, renders a certain parallelism in symptomatology at once apparent. The onset of a calculus colic, incorrectly called renal colic, is in many respects similar to the onset of a biliary colic. In both there is the sudden lightning-like onset, the same paroxysmal type of pain, the similar type but different allocation of the referred pain, and, finally, the same instantaneous relief with residual soreness. The genesis of both is similar and represents hyperactivity of a tube containing non-striped muscle-fibers.

Four main pathological conditions are apt to be confounded with renal lesions by reason of the symptom of pain. They are (1) coincident disease of the gall-bladder and ducts (Scarborough), (2) gastroduodenal ulcer syndrome, (3) appendicitis, and (4) affections of the large intestine. The anatomic relations of the descending and retroperitoneal portion of the duodenum, overlying the pedicle and the under and lower half of the right kidney, account for some atypical cases of jaundice with gastric irritability found in patients with ptotic kidneys. With these premises one will grant that the study of the diagnostic value of renal pain offers many inherent difficulties. There must be combined with the pain symptom other associated symptoms which are necessary to complete or fill out a diagnostic group. Valuable complements to pains are the presence of pathological products in the urine, nocturnal and diurnal variations in amount, frequency of micturition, with or without tenesmus, nocturia, etc.

Most of the affections of the kidney are in the beginning painless, and many of them remain so. We know that pain as a result of changes in the parenchyma of a glandular organ is extremely rare. As evidence of this we have the various nephritides of the chronic type that do not show pain unless there is a sudden, acute congestion associated with a chronic inflammation and capsular changes. In fact, it is almost an accepted dictum that it is necessary to have stretching or tearing or pressure upon the delimiting capsule of a parenchymatous organ in order to have the production of pain. Diseases of the kidney structure *per se*, as with the affections of other glandular organs, are practically devoid of sensibility. MacKenzie states that "all the symptoms of kidney disease (apart from alteration in the size of the organ) are found in the chemical examination of the urine, in the frequent micturition, or as the result of its impaired secretion on other organs and systems (vomiting, headache, convulsions, changes in the cardiovascular system, etc.)." When a renal lesion produces pain it does so either by changing the mechanical factors of urinary secretion or by direct involvement of the capsule or pericapsular tissues. Conditions associated with rapid enlargement of the kidney almost uniformly induce pain, while lesions confined to the parenchyma without either pelvic or capsular intrusions are uniformly devoid of pain.

In interpreting renal pain three considerations present themselves:

1. Type of pain.
2. Original location of pain.
3. Final location of pain and its path of radiation.

Kidney pain is of two general types: (a) true renal pain located in the flank and lumbar region, of dull aching quality, usually of maximum intensity, of constant character, and without radiation; (b) pelvic or ureteral pain, diffusely located from the lumbar region along the iliac crest, of paroxysmal or colicky quality, of varying intensity, of intermittent character with radiation through the inguinal region into the scrotum or rectum or on to the thigh.

In order to establish the fact that pain is of nephrogenic origin it must be correlated with some associated finding. When this is completed the clinical picture will catalogue itself into one or another of the following groups or syndromes, thus: pain with pus but without cystitis, suggesting the calculus group; pain with pus, with

cystitis, suggesting the tuberculous group; pain without pus, without cystitis, plus tumor, suggesting the aseptic hydronephrotic group; pain with tumor, with pus, with or without cystitis, suggesting the septic hydronephrotic group; pain with blood, without cystitis, the neoplastic or essential hæmorrhagic group. It is questionable if any inflammatory disease of the renal parenchyma *per se*, without enlargement of the kidney or encroachments into the pelvis, is associated with pain. The products of any infection, however, finding an exit into the pelvis may be retained under sufficient pressure to induce ureteral occlusion with typical calculous type of pain.

A peculiarity of true renal pain is that it never becomes paroxysmal, but is always characterized by dull, constant aching. Stooping is not painful, but local tenderness is found. Percussion with the whole hand, so-called fist percussion (Murphy), or a blow being developed by the ulnar side of the open hand (Thompson), will cause an intense, acute exacerbation of a true renal pain.

Infections of the perirenal tissues have localized pain as their most prominent symptom. It is constant, of aching character, continuous, and usually progressive. It is never paroxysmal or colicky, although colicky pain may be manifested when blood-clots, pus, or stone engage or occlude the ureter. Probably embolism or infarct of the kidney has as its most terrifying sign the development of pain, acutely, suddenly, like an apoplexy or a stroke of lightning, usually distinctly localized to the lumbar region. The pain of embolism of the renal arteries is distinguished from other true kidney pain only by the great suddenness of its onset. True kidney pain is almost always localized by the patient deeply, as away from the surface. It is away from the posterior abdominal muscle or the abdominal wall in front. This is of material aid in differentiating true renal pain from neuralgia or myalgia, which are more or less superficially located by the patient. Associated with pain are certain areas of sensitiveness of pressure. The most prominent are in the flank corresponding to the axillary line, the costovertebral angle between the lateral border of the erector spinea muscle and the twelfth rib, and anteriorly in the region just below the gall-bladder and representing the position of the pole and pelvis of the kidney. In lesions confined to the renal parenchyma, within the capsule and without pericapsular envolvement, the characteristic radiation of pain down on to the thigh is absent. It is only in rare cases that true intrinsic renal pain will be reflected on to the thigh. The kidney is not immovable, it is capable of quite a degree of mobility, and therefore, when inflammatory changes exist within the kidney or about the capsule, forcible manipulation of the organ is accompanied by more or less pain. This is also developed most acutely when the patient assumes certain positions. It is found that patients suffer most when lying upon the healthy side; and actual motion, such as coughing, vomiting, riding, and jumping causes an exaggeration of pain. The pain of infarct is so sudden as to suggest the passing of a stone down the ureter, but it is easily differentiated from the latter from the fact that the pain of infarct is after the onset, not paroxysmal or colicky, but constant, jabbing, aching, and progressive. Of additional value is the contraction of the iliopsoas muscle upon rising from bed or upon manipulation of the leg, causing an acute exacerbation of the pain because of the close apposition of the kidney to the muscle. Most abdominal pains are of colicky nature and the absence of paroxysms of pain in true renal pain is of great differential importance.

The pain of lumbago is very often mistaken for renal pain. It is well to remember that the pain from lumbago is worse in the morning and improves as the day progresses. It is a pain that is considerably lessened by movement and active locomotion. Pain of inflammation of the kidney is less after a night's rest and becomes progressively worse toward evening and with active locomotion. The moment the lesion involves the renal pelvis and upper ureter we have a distinct tendency to lose the constant, aching quality of true kidney pain and to have paroxysmal and colicky attacks with a marked tendency to radiation — the line of radiation being

clinically along the ureter, bladder, and scrotum, but anatomically along the distribution of the iliohypogastric, ilio-inguinal, and genitofemoral nerves. The pelvis of the kidney and ureter contain non-striated muscle fibres which, upon an exaggerated stimulation, such as calculus, blood-clots, bacterial agglutinations, particles of tumor-tissue, give rise to a distinct and typical type of pain. It is colicky, intermittent, paroxysmal, begins in the lumbar region, follows the iliac crest through the inguinal region on to the thigh or into the scrotum with retraction of the testicle. It may be argued that this type of pain, if it starts in the lumbar region and remains stationary, would point to an exaggerated peristaltic activity of the renal pelvis or upper ureter and the inference that the stone, etc., is stationary. If we find a history of repeated attacks beginning in the back similar to the above, we may assume that the stone is lodged in or near the pelvis of the kidney. If the stone is entirely surrounded by glandular tissue and does not project into the pelvis, it is questionable whether it can ever arouse the painful characteristics of calculus, for it seems to be conclusively proved that the excessive contraction of non-striated muscle-fiber is the cause of the pain, and the calculus acts as a stimulant to such contraction. A rather common history is represented by the patient who has had a colicky calculus pain which begins in the lumbar region and gradually descends along the iliac crest and inguinal region; finally the character of the pain changes and is referred to the end of the penis or perineum, and the next day the patient passes a small calculus per urethram. The successive segmental movement of this pain is coincident and simultaneous with the passage of the calculus from the ureter to the bladder. Any lesion in or about the pelvis, ureter, calculi, particles of tissue aneurism, or carcinoma of the bladder at the ureteral orifice will occasion the pain. Pyelitis, pylonephritis from septic occlusive changes in the ureter or pelvis, will also induce this type of pain.

It is not unusual for a pain, colicky in character, to become more constant and suggest a true renal pain. From partial or complete occlusion of the ureter, distention of the renal pelvis occurs and with it damage to the kidney itself and the subsequent production of an active hyperæmia, capsular and pericapsular infiltration, etc. Thus we have the pictures of an attack of pain, colicky in nature, subsiding, and the development of a constant, localized ache of true renal pain due to changes in the renal parenchyma with stretching of the capsule and pericapsular tissues. Bevan and others have shown that the pain of acute renal colic is due more to the congestive condition and swelling of the kidney than to direct irritation of any nerve connection. The genital branch of the genitocrural nerve contains the motor nerve of the cremasteric muscle and also the sensory nerve of the tunica vaginalis, which becomes hyperæsthetic in ureteral colic, the pain shooting into the testicle. It is to be remembered that the scrotal covering of the testicle is supplied by the sacral nerves and the skin of the scrotum is never affected in true renal pain.

In pelvic and high ureteral involvement, the skin of the scrotum is not painful on pressure, but the deep tissues are. In lower ureteral and adjacent bladder regions the superficial tissues are painful, with absence of pain in the deeper tissues.

A point of extreme diagnostic value is that distention of the renal pelvis and upper third of the ureter is associated with urinary frequency, but usually without painful micturition. The development of areas of referred hyperalgesia occurs with intrarenal lesions, while extrarenal lesions as a rule give local pain and absence of referred hyperalgesia.

Backache is erroneously credited to disease of the kidney, but an extended examination of cases of nephritis, acute and chronic, gives no particular evidence of pain referable to kidney trouble. What are we to say to those dull, uncertain backaches, the relation of which to the kidney is a matter of so much controversy? Kelly stated that 60 per cent of ill-defined, right-sided pain is probably due to some disturbance in the kidney or ureter. Of all the cases of movable kidney, it is probable that a few only suffer as the direct result of the condition. Unfortunately this condition ex-

ists in many people as part of a generalized visceroptosis. It stands to reason, however, that in a not inconsiderable number of patients there is a constant drag with irritation upon the renal pelvis and indirectly upon the solar plexus. We have then a hyperæsthesia of the autonomic system with neurasthenic symptoms referable to the stomach, etc. The reasonable explanation for this is that the kidney is enclosed in two layers of fat which fuse at the superior aspects and blend with the diaphragm, which is the cause of the pain that is produced by the varying degrees of nephroptosis. Such pain is distinctly referable to the tenth, eleventh, and twelfth dorsal nerves, and may be clinically reflected into the right shoulder through the phrenic part of the nerve supply of a diaphragm. A continuous irritation of the nerve-centers of the kidney may account for the clinical observations of Prout and Morris that a one-sided lesion of the kidney may cause pain on opposite side — the so-called renorenal reflex.

We must mention also the renal hæmorrhage with paroxysm of pain described by the French authors as *Nephralgie hematurique*. However, essential hæmaturia usually exists without pain. Pain when present is produced by the underlying factors, such as blood-clots, detached tissue, and ulceration.

It is also our opinion that pain production by renorenal reflex is not a proved entity and that a more painstaking diagnostic search will usually reveal a definite pathological condition responsible for the pain in the supposedly healthy kidney.

BLADDER FUNCTION AFTER CONFINEMENT AND AFTER GYNECOLOGICAL OPERATIONS

By FRED. J. TAUSSIG, M.D., F.A.C.S., Saint Louis

SINCE 1902, when I published a study of urine retention based on operative records from Wertheim's clinic in Vienna, considerable literature on this subject has accumulated. It has been more concerned, however, with the therapy of post-operative urine retention and cystitis than with an examination of the factors that bring it about after confinement or operations. Particularly do we lack data concerning the time of first urination after such procedures and the amount of urine voided, in relationship to the special conditions in each case. The present analysis of 157 puerperal and 405 post-operative cases is primarily with this object in view, and is based largely on material in the service of my colleagues and myself at the City Hospital during the years 1913 and 1914.

Frequency of catheterization. It was found that out of 157 puerperal cases 6 required catheterization one or more times. This would make 3.8 per cent as compared with 5 per cent given by Meixner, 8 per cent by Waldstein, and 18 per cent by von Winckel. Among the post-operative cases the number requiring catheterization was much larger, amounting to 94 out of 405 patients, or 23.2 per cent.

Physiology. No important contribution has been made in recent years to our knowledge of the normal process of micturition. According to Mueller, Roith, and others, there are no spinal centers to regulate bladder function. The desire to urinate is primarily aroused by the filling of the bladder. At first there is merely a sensation of tenseness, and then later one of fullness and desire to void. This sensation is carried from the vesical mucosa through the sympathetic ganglia to the lower portion of the spinal cord and thence to the brain. Through spinal nerves the reflex is then voluntarily released, which causes relaxation of the external sphincter urethra, and arouses the detrusor vesicæ to empty the bladder. The emptying can be hastened by pressure of the abdominal muscles. The centers controlling this function lie in the sympathetic ganglia of the hypogastric plexus and in the ganglia lying within the bladder-wall.

Normal puerperal cases. Before proceeding to a consideration of the cases requiring catheterization, it is important to study the

variations in those women who voided urine spontaneously. Of the puerperal cases, 3 voided within 1.5 hours after the delivery of the child. The longest interval between delivery and spontaneous micturition was 22 hours. The average of all, 157 patients, was a trifle over 7 hours.

The relationship of the duration of labor to the time of spontaneous micturition was found to be as follows:

Labor short — 7 hours or less —	
Urination after 5 hours or less	24 cases
Urination after 6 to 10 hours	14 cases
Urination after more than 10 hours	12 cases
Total	50 cases
Labor average — 8 to 15 hours duration —	
Urination after 5 hours or less	18 cases
Urination after 6 to 10 hours	37 cases
Urination after more than 10 hours	6 cases
Total	61 cases
Labor prolonged over 15 hours —	
Urination after 5 hours or less	9 cases
Urination after 6 to 10 hours	15 cases
Urination after more than 10 hours	5 cases
Total	29 cases

This indicates, as we would expect, that the shorter the labor the more quickly the bladder regains its normal function.

Perineal lacerations, on the other hand, did not seem to have any material influence in my series. Fifty-eight out of 151 had lacerations sufficient to require one or more sutures, but they showed no delay in voiding or increased proportion of catheterizations. The 87 primiparæ showed but a fraction of a per cent difference from the 64 multiparæ in the time of first voiding urine, the figures being 7.2 hours primiparæ, 7 hours multiparæ. The 18 operative deliveries in the series are hardly sufficient in number to justify any deductions as to time of spontaneous urination. They showed an average time of over 9 hours post-partum. The amount of urine voided was with few exceptions not stated in the puerperal cases.

Normal post-operative cases: The 405 post-operative cases covered almost every variety of gynecological operation. Leaving aside for the present the 94 cases requiring catheterization, we find that the 311 women who urinated spontaneously voided on an average at the end of 12 hours. The shortest interval after operation was 2.5 hours and the longest 33 hours. The following table indicates the distribution of these cases according to time.

1 to 3 hours	3 cases
4 to 6 hours	23 cases
7 to 9 hours	82 cases
10 to 12 hours	94 cases
13 to 15 hours	56 cases
16 to 20 hours	41 cases
Over 20 hours	12 cases

The amount of urine voided was not always proportionate to the time elapsing up to the first urination. Five women voided 1 ounce or less. One patient, on the other hand, voided 29.5 ounces. The average of the 311 cases was 6.9 ounces.

In my review of the literature I could find no accurate data as to the time and amount of the first spontaneous urination after operation. Holzbach states broadly that every surgeon knows he cannot expect spontaneous urination until 8 to 10 hours after the conclusion of an operation. When the patient voids, he says, usually only 50 to 60 ccm. is passed, rarely as much as 200 ccm. On catheterizing such a patient we obtain 300 to 800 ccm. of urine. Holzbach does not give the evidence upon which he bases this opinion. He concludes that after operation there is invariably a partial urine retention.

To test the accuracy of this statement, I made a comparison of 30 cases requiring catheterization with 30 cases of spontaneous urination after about the same time interval. The total urine obtained from the catheterized cases was 395 ounces in 463 hours, that from the uncatheterized cases was 247 ounces in 466 hours. The total period of time elapsing since operation being practically identical, we can fairly compare the quantities of urine in the two groups. According to this, an average of 13 ounces was obtained on catheterization, while only 8 ounces was voided by the patient, making approximately 5 ounces of retained urine in those women who voided late after operation. The following history will serve an illustration:

A round ligament abdominal fixation was done in a woman, age 32, under ether anæsthesia. After 15 hours she voided only

3 ounces; 5 hours later, again 3 ounces; in 30 minutes, 2 ounces; in 1 hour, 5 ounces; in 3 hours, 8 ounces; in 3 hours, 8 ounces; and finally, in 2 hours, 16 ounces. Thereafter urination was normal in amount and interval of time. Summarizing, we find 6 ounces voided in the first 20 hours, and 39 ounces in the following 10 hours. Only at the end of 30 hours, therefore, was the bladder function fully reëstablished.

One of the interesting observations made in gathering the data for the present article was that there apparently exists normally a "small capacity" and a "large capacity" bladder. Of course, gradations between these two types occur. In the 34 cases of what I term "small capacity" bladder, the average amount voided was 2 to 3 ounces; in the 17 cases of "large capacity" bladder the amount passed at a time was between 12 and 20 ounces. A typical illustration of the "small capacity" bladder occurred in a woman of 46, operated for pyosalpinx, who 5.5 hours after its conclusion voided 1 ounce of urine, one hour later voided 2 ounces, and continued thus at regular intervals to void 2 to 3 ounces without any indication of urine retention. The patient was not nervous. Apparently in this group we have to deal with a hypersensitive bladder in which even a small quantity of urine produces the reflex stimulation to micturate. An illustration of the "large capacity" bladder occurred in a woman of 21, operated upon for ovarian cyst, who 21 hours later voided 12 ounces, and then at long intervals passed 22 ounces, 12 ounces, 13 ounces, 14 ounces, etc. Here we have an example of lowered sensibility of the bladder mucosa. It is interesting to note that only 2 out of the 34 "small capacity" cases had to be catheterized (5 per cent as compared with 23.2 per cent of the whole series), whereas of the 17 "large capacity" cases, 9 or 52 per cent, were subjected to catheterization one or more times. Not a single one of the "large capacity" series voided for the first time in less than 10 hours. I could exclude age, anæsthetic, and operation as to any degree a factor in this striking difference. We may fairly conclude, then, that the degree of bladder sensibility may be directly responsible to some extent for the success or failure in the effort to empty the bladder.

Cases requiring catheterization post-partum. Stoeckel and Ruge in their cystoscopic examination of women after delivery found almost invariably an œdema surrounding the sphincter urethra. This was held responsible for the occasional cases of puerperal ischuria. Doederlein lays stress also on the increased capacity of the puerperal bladder as a factor in retention. Steuernagel found that while the normal bladder would hold only 450 to 550 ccm., the puerperal one could be made to contain, under pressure, as much as 1,500 to 2,500 ccm. In searching for the cause of urine retention in the six cases catheterized post-partum, I found that one of them had, indeed, to a marked degree a dilatable bladder. She was a multiparous mother of 34 years, whose labor was normal and lasted but 7 hours. During pregnancy she sometimes had to strain to empty her bladder. Eight hours post-partum and at intervals thereafter, she voided without difficulty. After 48 hours, however, owing to a fullness of the abdomen and restlessness, she was catheterized and 72 ounces of urine obtained. Eight hours later catheterization brought 41 ounces; then she voided spontaneously again until the fourth day, when catheterization became necessary and 70 ounces were obtained. Two subsequent catheterizations brought away 52 ounces and 45 ounces, respectively. I thereupon ordered a retention catheter inserted for two days. After it was removed, she was able to void normally 15 to 20 ounces at a time.

Twice the bladder atony post-partum could reasonably be attributed to severe operations: one, a difficult forceps for eclampsia, and the other a transperitoneal cæsarean section. In one patient a vaginal gauze pack could be blamed, since after its removal the next day the patient was able to void. Nervousness was probably responsible in one woman, since she had had similar difficulty in voiding urine after a simple curettement one year previously. In the remaining one of the six cases, no causes for urine retention could be found.

CASES REQUIRING POST-OPERATIVE CATHETERIZATION

	Voided	Catheterized Once	Catheterized Oftener	Catheterized over 3 Days
Salpingectomy for pyosalpinx	109	9	7	1
Salpingectomy for salpingitis	57	8	4	1
Salpingectomy for ectopic pregnancy	14	1	0	
Ovariotomy	9	2	0	
Laparotomy for retroverted uterus	61	12	7	2
Supravaginal hysterectomy (metritis, fibroid)	27	3	2	
Abdominal hysterectomy (metritis, fibroid)	29	5	3	1
Radical abdominal hysterectomy (for cancer cervix)	3	1	13	8
Excochleation for cancer of cervix	9	0	1	
Vaginal operation for prolapse	7	7	6	3
Perineoplastic	18	5	14	6
Other external genital operations	2	2	3	2
Miscellaneous	10	0	2	

Cases requiring catheterization after operation. The 94 post-operative cases in whom the use of the catheter became necessary give a better opportunity for etiological study. In six, for special reasons, catheterization was ordered independently of the patient's ability to void, and these of course have been excluded from our consideration. An analysis as to operation and disease reveals the findings in the table above.

Where several operations were done on the same person, they were tabulated under each head. In my statistics of 1902 I found that the interposition operation for prolapse and the radical abdominal operation for cancer of the cervix were particularly often followed by urine retention. Subsequent writers have confirmed these findings, and the present table is also in accord with them. Gutbrod mentioned the frequency of retention after Alexander's operation for retroversion, but cited no figures. Certainly the abdominal round ligament operation for retroversion can only to a limited degree be held responsible for urine retention. Far oftener did we find it after work about the external genitals and perineum.

INFLUENCE OF ANÆSTHESIA ON MICTURITION

	Total Number	Voided	Interval to First Urination, Hours	Catheterization 1 X	Catheterization Often	Per cent Catheterized
Puerperal cases without narcosis	139	135	6.7	3	1	2.8
Operative puerperal cases (small amount of ether)	18	16	9	2	0	11.1
Spinal anæsthesia gynecological cases	88	62	10.5	10	16	29.5
Ether anæsthesia gynecological cases	311	245	12	33	33	21.2

Influence of anæsthesia. As long as the will is excluded either by narcosis or its aftereffects, the reflex process of urination cannot be established. That is why in autopsies on persons who have had a slow death, the bladder is always found filled with urine. Under spinal anæsthesia the central nervous system is not directly affected, but the chain of reflex action is broken by paralysis of the centripetal and centrifugal spinal nerves. Until this chain is reëstablished, we should expect some interference with the normal mechanism of urination.

In our series the influence of anæsthesia upon the bladder function could to some degree be studied by comparing the puerperal and post-operative cases. In the puerperal group where practically no anæsthesia was required, the interval up to the first micturition was only about 7 hours, whereas in the post-operative group the interval extended to 12 hours. Of special interest is the comparison of the 88 spinal anæsthesias with the 311 ether anæsthesias.

A comparison of 58 spinal cases with 58 ether cases, all of whom voided spontaneously, showed that the average time of post-operative voiding of urine in spinal cases was 10.5 hours, while in the ether cases it was 12 hours. In view of the fact that a considerable number of spinal anæsthesias were done for prolapse and cervical cancer, a comparison of the percentage of catheterization would be manifestly unjust. A fairer basis for comparison lies in the time of the first spontaneous urination as cited above; and this would indicate that, of the two, ether narcosis has a more prolonged paralyzing effect on the bladder mechanism.

Age was found to influence somewhat the

frequency of catheterization, as seen in the accompanying table:

	Voided	Catheterized	Ratio
Under 20 years	47	8	6 to 1
20 to 30 years	146	32	4.5 to 1
30 to 40 years	74	30	2.5 to 1
40 to 50 years	24	13	2 to 1
50 to 60 years	6	11	1 to 2
More than 60 years	1	4	1 to 4

Apparently it can be said that the younger the individual, the better the bladder tonus and the less frequent do we find disturbance of micturition. In analyzing the various other causes that might be held responsible for urine retention, I took note of such points as shock, duration of operation, extreme nervousness, vaginal or abdominal drains, unusually large amount of morphine[1] administered after operation, mental deficiency, etc. In 14 instances no cause could be found for the urine retention. In the remaining 74, I attributed it to —

Bladder plastic	17 X
Bladder pressure (retroversion)	14 X
Bladder innervation (cancer cervix)	11 X
Vaginal or abdominal drains	14 X
External genital operations, including perineum	13 X
Nervousness	8 X
Shock or long operation	8 X
Large quantity of morphine	3 X
Mental deficiency	2 X

A number of these cases were classified under several heads. The important factors in urine retention, therefore, are interference with the blood supply of the bladder, direct or indirect pressure or irritation around the sphincter urethra, excision of the bladder nerve supply, and interference with the control of the central nervous system through anæsthetics, drugs, or mental processes.

The 21 cases of prolonged urine retention (over 3 days) occurred 8 times after the radical cancer operation, 6 times after perineal plastic, 3 times after prolapse operations, twice after excisions of vulvar carcinoma, and in the remaining instances without explainable cause.

Occasionally patients were able to void one or more times before catheterization became necessary. This occurred particularly often after the interposition operation for prolapse. Temporary incontinence of urine occurred 8 times in my series, and, since half of this number followed spinal anæsthesia, the latter may to some degree have been responsible. The history of the cases gave no satisfactory explanation other than this as to the cause of the incontinence.

Retention after radical operations for cancer of the cervix. The most difficult problem in urine retention is still the paralysis following the radical cancer operation. In practically every instance catheterization is here necessary for a period of 6 days or more. The presence of large numbers of nerve ganglia in the parametrium removed at operation induced me, in 1902, to explain urine retention in these cases on the basis of excision of bladder innervation. Most gynecologists have concurred with this view. Since 1905 I have done 31 such operations, and of this number only 2 were able to void spontaneously. Both were very early cases without involvement of the parametria. Of late I have adopted the use of a retention catheter in spite of the unfavorable reports of Sampson and Hannes. Franz, of Berlin, strongly recommends its employment. I have preferred not to use the mushroom type as Franz does, but rely upon the ordinary catheter held in place by adhesive plaster externally. Such a catheter can be readily taken out for an hour or more every day to be resterilized. We thus prevent the pressure narcosis and infection around the sphincter urethræ that so often attends the prolonged use of a mushroom catheter.

Since asepsis of the urethra is impossible, we must try to combat the germs that gain entrance into the bladder through catheterization by antiseptic methods. Urotropin is given in liberal doses — 10 to 20 grains 3 to 4 times a day if tolerated, always in association with acid sodium phosphate. As a prophylactic against bladder infection we have preferred the frequent instillations of non-irritating silver solutions, such as 20 per cent argyrol, rather than irrigation with feebly antiseptic solutions like boric acid, as suggested by Baisch. Before a cystitis is present, there is no advantage in irrigation over instillation, for there is nothing to wash away. What we want is the greatest antiseptic

[1] Morphine is mentioned by Szapek and Wassermann as occasionally responsible for pronounced urine retention.

effect accompanied with the least irritation. In spite of all these precautions, a certain number of cases will develop a cystitis, but it is usually mild and responds promptly to the customary local treatment. My recent experiences have convinced me that the danger of infection lies less in the technique or frequency of catheterization than in the presence of urine stagnation in the bladder. Albeck found that in 130 women who had a residual urine in their bladder, bacteriuria was present 52 times, whereas in 120 women without residual urine only 16 had bacteriuria; in other words, we are less concerned with the comparatively few germs that gain entrance into the bladder than we are with seeing to it that they have no opportunity to multiply within that organ. Some of my most serious infections occurred in women in whom I had ceased prophylactic measure as soon as they began to void spontaneously. These women not infrequently had partial retention with stagnation of urine. Prophylactic treatment, therefore, must be continued until the bladder fully empties itself.

Prophylaxis of urine retention. The ordinary procedures need not here be considered. Werth's suggestion to fill the bladder at the conclusion of the operation is often unsuccessful and may lead to disturbance in wound approximation. Massage, as recommended by Schroeder, is only suitable for puerperal cases and is rather a rough procedure for so delicate an organ as the bladder. Ries and others claim to have had success in practically all cases by allowing patients to get out of bed to void. Leaving out of consideration the dangers accompanying such measures, when used after long confinements or serious operations, we have repeatedly observed, particularly in the group of prolapse and cancer cases, that, while the patient was usually able to void in this position, only an ounce or two was passed at a time, so that catheterization still had to be resorted to to prevent stagnation of urine. Jansen, however, found post-operative cystitis much less frequent among patients who got up a few days after operation than among those who were confined to their bed a longer time.

In the past five years there have been many enthusiastic reports concerning the effect of pituitrin in urine retention. Ebeler found it successful in almost all of his 45 cases, but he did not include any prolapse or cancer operations in his series. Further he insists that it is effective only in bladders that are filled to capacity. It would therefore be inexpedient to use it in any patient on whom a retroversion operation had been done. Jaschke also found it a successful means of stimulating the bladder in four-fifths of his 44 cases, but R. Franz, on the other hand, met with 9 failures out of 12 attempts. The few times I have used pituitrin, I have had only varying success. Since, however, it does away with the necessity of bladder treatment, it should be given a trial in the lighter grades of urine retention. I would suggest in suitable cases using it in combination with getting the patient out of bed.

Ever since Baisch, in 1903, advised the injection of 20 ccm. of a 2 per cent boroglycerine solution into the full bladder, it has been generally adopted in the treatment of urine retention. In the more prolonged retention cases it fails to give results. I object to this method of treatment partly on this account and partly because in a number of cases I got the impression that the irritation of the glycerine was responsible for the severity of the attendant bladder infection.

While I have not had occasion to try the soap-glycerine bougies of Waldstein, I should think the same objections would hold true of them, beside which the application and keeping of such bougies seem unnecessarily complicated.

In searching for some mild intravesical irritant that would be easy of application and would not predispose to severer infections of the bladder, I decided to try the effect of simply injecting several ounces of air into the full bladder. The many occasions on which, in using air dilatation with a Kelly cystoscope, I had occasion to observe pronounced bladder contractions as a result, made me feel that the mildly irritant effect of air might relieve the urine retention. Thus far I have used it eleven times, with success in all but one case. The technique is simplicity itself. If urine has not been voided for 12 hours

after operation, and the usual methods of heat, etc., have failed to have any effect, two ounces are injected through an air-tight syringe into the full bladder. Since it does not mix with the urine, the air acts as a very mild but persistent stimulus to bladder contraction. In case the bladder seems very full, a few ounces of urine can be allowed to escape before injecting the same quantity of air.

I have not as yet had occasion to try it in the prolapse or cancer cases, but certainly in the latter class I should expect no result whatever. I have observed after several radical cancer operations a bladder atony so pronounced that after catheterization with the patient's hips elevated, the negative pressure permitted a considerable quantity of air (probably in the neighborhood of two ounces) to be sucked into the bladder. In no instance did this awaken spontaneous urination. Such a bladder paralysis as this defies any treatment but a retention catheter and time.

In conclusion, then, it appears that while there are all gradations of deficiency in bladder function after confinement and operation, we can for practical purposes divide patients into four groups:

1. Those who show at such times no appreciable change from normal micturition.

2. Those who, although able to void spontaneously, do not for a day or two empty their bladder completely.

3. Those who require catheterization one or more times in the first few days, but are then able to void without further trouble.

4. Those with prolonged interference of bladder function.

The character and duration of the operation or labor, the form and amount of the anæsthetic, the age of the patient, the nervousness of the individual and the degree of sensitiveness of her bladder mucosa, are all factors that to a greater or less degree come into play in introducing urine retention; and our object should be to regulate our therapy as far as possible in accordance with the probable factors in each case.

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LABORATORY DIAGNOSIS OF CHRONIC INFECTIONS OF THE URINARY TRACT IN WOMEN

By ARTHUR H. CURTIS, M.D., F.A.C.S., Chicago

IN the study of chronic infections of the urinary tract distinct advantages are possessed by one who adds clinical experience and a knowledge of cystoscopy to active participation in laboratory work.

Division of labor in this field tends to introduce many errors. The laboratory worker knows little concerning which procedures are best adapted to the establishment of a diagnosis unless he is conversant with the clinical findings and special features of importance as revealed by cystoscopic examination. On the other hand, the clinician who depends upon laboratory reports is also handicapped, for he seldom knows whether specimens arrive at the laboratory in proper condition, or whether they have been satisfactorily examined without delay. A routine report is at best but a poor substitute for personal study of the material.

SPECIAL FACTORS OF IMPORTANCE IN ROUTINE EXAMINATION

Pus. There is a tendency to disregard a moderate amount of pus in the urine on the assumption that it is ascribable to contamination from a vaginal discharge. The discovery of its presence should be followed by examination of another specimen secured after a preliminary douche and tamponade of the vagina, or, better, after withdrawal by catheter.

Likewise, too little emphasis is laid on the fact that *persistent pyuria*, in the absence of a gross bladder lesion, such as stone or retention of urine, is almost invariably due to kidney disease. It is to be regretted that the profession is not more impressed with this fact and not more awake to a realization that the place of formation of urinary pus can be definitely localized through the assistance of ureteral catheterization.

In the examination of ureteral specimens little significance attaches to excessive flow of urine from one kidney. Nor should we forget, in event of catheterization polyuria, that but few pus-cells may be evident in a kidney specimen which under usual conditions contains pus in abundance.

Idiopathic hæmaturia. Among the causes of hæmorrhage in cases formerly classified as idiopathic hæmaturia, not only is there the possibility of a hidden tuberculous focus, but increasing experience with cultures forcibly impresses me with the frequency of other infections. No case can rightfully be relegated to the idiopathic class until modern cultural methods, especially anaërobic cultures, have failed to show infection.

Bacteria. When there is urinary retention, or if treatment has included bladder irrigation, bacilluria is naturally of frequent occurrence. It is worthy of note, however, that urine from normal individuals tends to be bacteria-free. This lends added interest to the work of G. F. and G. R. Dick, who regularly secure positive cultures in cases of nephritis and are able to produce experimental nephritis through injection of specific nephritis-producing organisms.

Without entering into a discussion of vaccines, I wish to emphasize a belief which is becoming more firmly rooted as my experience increases: autogenous vaccines, in infections other than those with bacilli of the colon group, are sometimes beneficial, but do not commonly cure the patient; colon bacillus vaccines, on the other hand, yield a surprisingly high percentage of cures. Failure to obtain results with carefully prepared and administered autogenous colon bacillus vaccines is indicative of trouble greater than a simple infection, such as kidney abscess, stone, retention of urine, or complicating tuberculosis.

THE MAKING OF CULTURES

Media. One per cent dextrose ascites agar shake cultures give more uniformly satisfactory results than any other media I have used. Growth often occurs in this when blood-agar slants and plates remain sterile.

Failure to obtain growth on plates is more usual than is generally recognized, although employment of a moist chamber materially adds to the percentage of positive results.

A technique which may be employed in special cases when bacteria are widely scattered and grow with difficulty is the following: Centrifuge the catheterized specimen as usual. Mix the sediment with a few cubic centimeters of blood and make a large number of ascites blood-agar tubes containing less than the usual percentage of blood. If bacteria are present they encounter ideal conditions for growth, and colonies which develop in the slightly blood-tinged culture media are readily seen and isolated. Imbedded colonies are exposed by breaking the tube at any desired level; this is accomplished through stroking with a file, followed by application of a red-hot glass point.

Repetition of cultures. The presence of very few colonies, especially if these show organisms of more than one kind, gives rise to uncertainty best relieved by making a fresh set of cultures. Likewise, the finding of certain bacteria which are common sources of contamination suggests a slip in technique. Before deciding that these play a rôle in the production of disease, it is well to repeat the work with careful scrutiny of all details.

Anaërobic cultures. The French have shown that anaërobes play an important part in infections of the urinary tract. Anaërobic cultures should be made in the majority of cases; the dextrose agar shake technique and the pyrogallic acid method of Wright have a simplicity that commends them.

Ureteral cultures. With all care in preparing cystoscopes and catheterizing ureters, even moderate surgical cleanliness is difficult; satisfactory technique for bacteriological cultures is still less easy to attain. On this account cultures of ureteral specimens should be controlled by simultaneous study of the bacteriology of the bladder urine.

Cultures when urine proves sterile. In those patients who suffer with irritability of the trigone and urethra, and who void urine which is persistently clear, cultures often show no growth. At such times cultures from a probe passed into Skene's ducts with deliberate traumatism of the lining membrane may yield colonies of the gonococcus. Less often, growth results from cultivation of material obtained after massage followed by introduction of an applicator into the urethral canal.

LABORATORY DIAGNOSIS OF TUBERCULOSIS

It is common knowledge that idiopathic hæmaturia or pyuria makes advisable a search for evidences of tuberculosis, and that colon bacillus infection of the urinary tract, without a history which accounts for its presence, may conceal an underlying tuberculous infection. Also, when locating the focus of infection, it cannot be too often emphasized that the presence of tubercle bacilli in the urine commonly signifies a *renal* tuberculosis, and not an infection confined to the bladder. It is true that bacilli may filter through the urinary tract without producing a lesion, but such occurrences, with tubercle bacilli numerous enough to be found in the urine, must be uncommon indeed.

The ease with which advanced tuberculosis is recognized permits us to especially consider those cases with less evidence of the disease. In the examination of patients in whom definite findings are difficult to obtain, certain details in technique may be advantageously employed: Provided the lungs are normal, potassium iodide may be given for a period of several days; this is followed by the administration of one-tenth milligram old tuberculin twenty-four to forty-eight hours before examination. Massage of the kidneys several times daily in conjunction with the iodide and tuberculin tests aids in the production of a focal reaction. Finally, liquids are limited to a minimum before collection of specimens, with the twofold object of irritating the kidney through concentration of solids and increasing the number of bacteria in a given quantity of urine.

As a routine procedure, medium-sized guinea pigs are injected intraperitoneally with the sediment from several tubes of centrifuged urine previously washed with normal salt solution to decrease its toxic action. Injection into the liver or traumatized inguinal glands is probably best reserved

for urgent cases, and should be controlled by intraperitoneal injection of other pigs.

A high-power centrifuge is essential in the search for bacilli in fresh specimens. These machines are vastly superior to the ones in ordinary use and make immediate examination of the urine a procedure of much diagnostic value. It would seem scarcely necessary to mention that numerous specimens should be examined in all doubtful cases.

The organisms with which tubercle bacilli are likely to be confused are chiefly smegma bacilli and water contaminations. Consideration of the clinical history, care in collection of specimens and in differential staining, animal inoculation, and cultivation by Petroff's method[1] are useful at such times. Petroff's technique promises to be of much aid, and gives more prompt results than animal inoculation.

FUNCTIONAL TESTS AND NEPHRECTOMY

Consideration of functional kidney tests would too greatly extend the confines of this paper. Therefore, only one phase of the subject will be mentioned in closing.

Phenolsulphonephthalein and other functional tests are unquestionably of value when nephrectomy is under advisement. I wonder only whether we do not lay too much stress upon their importance. The characteristics of the urine from the opposite kidney — its amount and specific gravity, the quantity of albumin, pus, bacteria, and casts contained, always with consideration of just how much disease and how much secretory power the questionable kidney reveals — still remain, to my mind, the most reliable guides.

[1] Petroff. J. Exp. Med., 1915, xxi, Jan.

CONCLUSIONS

1. Chronic infections of the urinary tract can be best diagnosed by one who is actively engaged both in clinical work, including cystoscopy, and in laboratory study. Careful correlation of clinical findings and laboratory methods, with extensive modifications in cultural technique to meet individual cases, is essential.

2. The source of even small amounts of pus in the urine should be investigated; the place of its formation can be definitely localized through ureteral catheterization.

3. Persistent pyuria in the absence of a gross bladder lesion is almost invariably due to kidney disease.

4. In those frequent cases with bladder irritability which yield clear, bacteria-free urine, cultures from the traumatized urethral canal, or from introduction of a probe into Skene's ducts, may demonstrate the cause of infection. When bacteria are widely scattered or grow with difficulty, a mixture of the urinary sediment with blood, followed by the making of a large number of ascites-blood-agar tubes of high dilution, results in conditions favorable for the development and isolation of the bacteria present.

5. Experience teaches that the chief lesions in urinary tuberculosis are usually renal. In obscure cases, laboratory diagnosis is facilitated by potassium iodide, tuberculin, kidney massage, limitation of liquids, repeated examinations of fresh specimens after high-power centrifugation, Petroff's cultures, and injection of series of medium-sized guinea pigs.

6. There is seemingly a tendency to lay undue stress on functional urinary tests at the expense of careful routine examination.

SOME ERRORS IN THE DIAGNOSIS OF RENAL INFECTIONS

By ARTHUR L. CHUTE, M.D., F.A.C.S., Boston

THE objective signs of renal infection, as shown by the urine, are so definite that the application of exact diagnostic measures, namely, the use of the catheterizing cystoscope and the microscope, should, in practice as well as in theory, lead to the correct recognition of these cases in all but rare instances. That this is not the case I think any one with any considerable surgical experience will attest. In this paper I shall give what I have found to be some of the common errors in the diagnosis of renal infections, and the reasons for these errors. First, I will take up some of the reasons for these errors.

In my opinion the greatest cause for errors in the diagnosis of renal infections is a lack of appreciation on the part of the general practitioner, under whose care these cases come first, of the conditions under which renal infection gives pain, and the sort of pain that such an infection usually gives.

In the first place, I believe that due to the nerve supply of the kidney, only a condition that suddenly puts tension on the kidney capsule causes renal pain. This limits the appearance of pain to acute infections that are attended with so much swelling or congestion as to sharply overdistend the renal capsule. That every acute infection of the kidney does not do this is proved by the great number of cases of acute pyelonephritis that one sees where there is relatively little pain, due to the fact that the swelling is not sufficient to distend the capsule to the painful point.

In the chronic renal infections pain is not a prominent symptom, unless there are combined with the infection attacks of intermittent obstruction that suddenly distend that part of the capsule covering the pelvis of the kidney. Slow distention of the kidney, even if it is quite marked — like that of a renal tumor, for instance — is rarely attended with acute pain. Apparently in such conditions the capsule has time to adjust itself to the changed relations.

In these cases where there is pain due to an infection of the kidney, it will be found that the pain is rarely backache, which is the only type of pain that many are willing to believe an infection of the kidney produces. The pain, it is true, may have its origin in the loin and under certain conditions remain there, but there is a great tendency for it to become generalized abdominal pain, and it may be abdominal from its very start. This, I think, is especially likely to occur in cases where the pain is very severe; as, for instance, in the distention of the kidney capsule that occurs during the passage of a ureteral stone along the ureter.

Not only is the pain abdominal in type, but frequently, especially when acute, it is accompanied with vomiting which further tends to center the attention upon the abdomen rather than the kidneys. In these cases of renal infection, the tenderness, of course, is largely limited to the loin, regardless of the position to which the pain is referred. To have a typical pain across the small of the back, of the type that so many people demand before suspecting an acutely infected kidney, it would be necessary to have a double renal infection — a relatively rare condition. The lack, then, of pain which in the eyes of the general practitioner suggests pain of renal origin, is one reason why many patients suffering from kidney infections are not sent to the men who have the means and the skill by which alone accurate diagnosis of renal infection can be made. In passing I may say that I feel it is as much out of the question to expect the general practitioner or the general surgeon to be able to do this work accurately, as it is to expect either of them to make, for instance, a complicated examination of the eye. Nor do I believe that this work is ever going to be done accurately except by those men who devote a great deal of their attention to it.

There is yet another point that throws the general practitioner off his guard in dealing with these cases of renal infection. This is

the lack of renal tube casts that the urine from an infected kidney ordinarily shows. Casts are so intimately connected with the medical diseases of the kidney that many men feel that their absence indicates freedom from any form of renal disease. Casts, it is true, are not necessarily absent in infections of the kidney, but on account of the large amount of pus often present, they are relatively infrequently recognized.

This lack of the sort of pain that is supposed to indicate kidney disturbance, and this lack of renal casts, are often associated with a frequency and urgency of urination that point to an acute infection of the bladder, and acute cystitis is considered sufficient in the opinion of many men to account for the pyuria and the possible elevation of temperature that the case shows. The accounting for an elevation of temperature by a cystitis is, I believe, a very common error; it has been my experience that one rarely sees any appreciable elevation of temperature with a cystitis, and that urinary suppuration which is attended with any real elevation of temperature is almost invariably renal in origin, though elevation of temperature may be seen in those instances where a cystitis is accompanied by a prostatitis or vesiculitis. In women, I believe any urinary infection accompanied with temperature can be referred to the kidneys.

Errors in the diagnosis of renal infection are due almost entirely to the fact that the possibility is not brought to the mind of the man who sees the patient originally, and therefore accurate measures for diagnosis are not applied.

There is another and smaller class of cases, however, in which the error arises from the fact that, though the chance is afforded, we are unable for one reason or another to apply our accurate diagnostic means. Sometimes this is due to the fact that the patient is seen under circumstances that make this impossible; then again, it may be due to the fact that we are unable to catheterize the patient's ureters, because of some physical impediment, such for instance, as a flexed and adducted thigh, due to old hip disease, or an extrasensitive bladder or one that bleeds especially easily. The classical requirements for successful catheterization of the ureters are: a urethra that will allow the passage of a cystoscope; a bladder that will hold a moderate amount of fluid; a bladder in which the fluid can be kept sufficiently transparent so that one can see. These are necessary for the accurate diagnosis of most renal infections.

There are other cases where error in the diagnosis of a renal infection is due to the fact that the conditions seem so evident that the application of the exact means does not seem necessary or worth while. This condition perhaps is most strikingly exemplified in cases where the compensatorily hypertrophied kidney is taken out, in cases of one-sided renal tuberculosis. No matter what the immediate reason, the underlying cause for errors in diagnosis of renal infection is the fact that for some reason, avoidable or unavoidable, the methods of exact diagnosis have not been applied.

It is easiest to illustrate my points by citing briefly cases that have led to mistaken diagnosis. Naturally these cases for the most part have been those in which the error has been on the part of some one else. My own errors, though probably equally good for purposes of illustration, have remained for the most part for some one else to discover and are not available for my own use.

The commonest errors occur in the cases that are either unattended with pain or in which, if they present pain, it is referred to the bladder. The importance of these errors depends on the type of infection in the first instance and also upon its intensity. Thus the ordinary pyelitis, due to the common pyogenic organisms, is usually considered a cystitis, and during the acute stage I am inclined to think that perhaps it is just as well it is not recognized, lest there might be an unfortunate attempt to treat it surgically. Ordinarily it is only in the cases where the process becomes chronic and a careful examination is made that the condition is recognized.

These cases are so commonly seen as to make it hardly worth while to give an example. A typical instance was the following:

A young woman in the early twenties, who, following the birth of her first child, had repeated attacks of frequent and more or less painful urination. This had persisted over a year or more and treatment had failed to give her relief. Her urine showed pus in rather small amounts with a moderate number of organisms, supposed to be colon bacilli. Her bladder was fairly tolerant and showed a little congestion at the base. The urine from her right ureter showed a little pus and some organisms. The pelvis would hold only about 7 ccm. A ureter catheter showed normal urine from the left kidney. Washing out the right renal pelvis a few times with a weak solution of nitrate of silver was followed by freedom from symptoms and by a transparent urine. I was unable to palpate her right kidney or to get any tenderness. The bladder symptoms in this patient were considered due to some pelvic condition following her confinement.

Had a catheter specimen of her urine been examined — a thing which should always be done in women who complain of bladder symptoms — evidence of urinary infection would have been unmistakable. In women it is very unsafe to draw any negative conclusion from a voided specimen of urine. There is a great tendency in drawing conclusions based on such specimens to assume that the little pus and few organisms that the urine may show in a mild pyelitis are of vaginal origin.

A pyelitis is ordinarily to be suspected when, with the signs of a urinary infection, there is associated a moderate temperature or when the urine shows rather more albumin than the quantity of pus would account for. The finding of tenderness in one loin heightens the probability of pyelitis. The finding of the products of infection coming from a kidney on catheterization of its ureter clinches the diagnosis.

Errors in the minor infections of the kidney are usually not very important. With the more intense grades of infection an error in diagnosis is more important. I will cite a case of this sort that recently came under my observation.

A woman of 61 was seen late in February; for a little more than a week she had been having frequent and painful urination. Her bladder had been treated locally without relief, and for a day or two before she was seen her urine had been bloody. She had a temperature of 99.2°, she was voiding urine every ten or fifteen minutes; her urine showed considerable pus. Cystoscopic examination was very unsatisfactory as her bladder would hold only a little over an ounce. There was a question of dilatation of the mouth of the right ureter. Catheterization of the ureters was, however, out of the question, because of the sensitiveness of the bladder. There was a slight tenderness in her right renal region. Symptomatic treatment was advised. She improved for a time, then her temperature went up; she had chills and her right kidney became plainly palpable. Her bladder was so hypersensitive that there was practical incontinence. Cystoscopic examination, even under ether, was without result. The right kidney was exposed, a pus-containing kidney found and incised, and a large tube put down into its pelvis. Later the dressing showed the characteristic color of the pyocyanus infection. Ten days after operation I was able to catheterize both ureters with ease. The left ureter showed a normal urine, as might be inferred from the drop of temperature to normal and the greatly increased bladder tolerance following drainage.

In this case an error was made in assuming that an infection that proved to be renal was confined to the bladder. At the time of operation I was unable to remove the diseased kidney, because I was unable to apply our exact methods of diagnosis, due to a hypersensitive bladder.

Since in tuberculous infections of the kidney one rarely has a sufficiently acute swelling to overdistend the renal capsule and therefore to cause pain, the subjective symptoms are usually referred to the bladder. If a renal infection is tuberculous, delay in its recognition is important, since it may lead to a deeper involvement of the bladder, and consequently, to a longer period of recovery following the removal of the kidney, if, indeed, it does not bring about changes in the deeper layer of the bladder which will lead to permanent interference with its function. Then, too, there is the small danger of an ascending infection on the other side.

A woman, age 32, single, seen some months ago, illustrates well the bladder symptoms of renal tuberculosis. This patient fell, some four or five months before I saw her, striking the abdomen over the general region of the bladder. She began shortly afterward to have frequent and painful urination, at times passing a bloody urine. She had a good deal of treatment for her bladder, including a month's stay in a hospital with daily bladder irrigations, but had no relief. When seen by me her bladder was decidedly intolerant. Her urine showed pus and tubercle bacilli. There was redness about her right ureter; her left ureter was catheterized

and gave a normal urine. There was difficulty in catheterizing her right ureter, and so the attempt was not persisted in as it was evident, even without the slightly enlarged, slightly tender right kidney, which could be felt on palpation, that the signs of infection came from her right side. A typical tuberculous kidney was removed through a lumbar incision and four months later the patient had gained thirty pounds in weight and was free from her frequency, except when she was very tired. Her bladder still showed a somewhat abnormal condition which was steadily improving.

The renal infections that are attended with pain, especially when this pain is referred to the abdomen, are quite naturally the ones that are mistaken for the commoner acute abdominal conditions. An acute appendicitis is the most common acute abdominal lesion, as well as the one that often presents very atypical symptoms. It is this condition with which a right renal infection, giving abdominal pain is most often confused. There is a condition that simulates appendicitis especially well, and of which I remember having seen two examples. This is where there was a renal infection due to a stone blocking, in one instance the kidney pelvis; in another, the ureter in the general region of the third or fourth lumbar vertebra. The acute general abdominal pain due to the renal distention and infection, combined with a tenderness due to the presence of the stone in the ureter, gives a picture that I believe is almost sure to mislead. It is only when the appendix is found to be normal or the attacks persist after it has been removed that a more careful search is made and the condition is recognized. The following is one of the cases I have just referred to.

Some time ago I saw a young woman of 23 who had been operated upon for appendicitis about three years before. Following her operation for appendicitis she had two operations at intervals of some years to separate adhesions that it was believed followed the operation for appendicitis and which it was supposed produced the frequent attacks of abdominal pain which she suffered. When I saw this patient she had just recovered from one of these attacks of acute pain attended with vomiting. Her urine was turbid and had been for several years according to her history. She had found it necessary for a long time to get up at least twice at night. A slightly enlarged right kidney was made out. Radiography showed a stone in her right kidney pelvis. This was removed, and when the patient was last seen, a year after her operation, she had had no recurrence of her acute pain.

In this patient the history of urinary symptoms, frequent urination, and a long-standing turbid urine should have led to a more careful examination, especially of the urine. The microscopic examination of this alone should have raised the question of her trouble being of urinary origin.

While it is undesirable to remove a normal appendix because of the abdominal pain due to an infected kidney, this is a slight misfortune compared to overlooking an acute appendix and allowing it to go on to rupture and possibly a fatal outcome, because there is a chance that the pain may be due to an acute infection of a kidney. I therefore think one cannot advise being too fearful of making a mistake of this sort, as the other alternative is more disastrous. I believe, however, that there is a golden mean that will diminish the unnecessary operations and not jeopardize the patient's safety.

Other renal infections may be confused with certain painful non-surgical conditions of the intestinal tract, as was a case of slightly infected hydronephrosis that I saw in a woman of 60 some two or three years ago. She had had attacks of acute abdominal pain since she was a little girl. These had been considered various things, and she had been given all sorts of treatment, often with temporary benefit, but with no lasting relief. A little while before I saw her she had passed bloody urine on one or two occasions. I found an intermittent hydronephrosis on her right, mildly infected. The removal of her right kidney, which was little more than a shell, did away at once with her pain, and more than two years after operation she had had no recurrence of her symptoms.

An infected right kidney may give symptoms that may be mistaken for those of cholecystitis, as exemplified by a man of about 30 whom I saw some two years ago. This man had attacks of acute pain in his right loin that later became general abdominal pain. His appendix had been removed and at a later time his gall-bladder was opened, but no stones were found. His attacks persisted. He was radiographed and found to

show a stone low in his right ureter as well as one in his left kidney pelvis. Both were removed and the man was perfectly well for a considerable time afterward, though I am told that during the past winter he had an attack of pain followed by the passage of a small renal stone.

A patient of 30 whose second child had been born a year or two previously came under my care some five years ago. She had had several operations, mostly for pelvic conditions. The year before her left ovary had been removed for pain which had persisted until the time that I saw her. It had been unchanged in character and it seemed fair to believe was due to a kidney. She had had urinary symptoms for some time; not only a very turbid urine, but likewise a leakage of urine. Bladder examination showed a much dilated left ureter from which were pushed out at times solid molds of pus. Palpation of her left loin showed a mass that was tender and the size of a large orange. Examination of the bladder likewise showed an abnormal opening to the inside of the left ureter. This proved to be a vesicovaginal fistula. The left kidney was cut down upon and removed. It was simply a pocket of pus, the walls of which were very much thickened, showing, in my opinion, that it was of long standing. The vesicovaginal fistula was likewise closed and when last heard from the patient had been free from her former attacks of pain and temperature.

The above illustrate the commoner types of error in the diagnosis of infections of the kidney as I have seen them. The list of individual errors, however, might be very considerably increased. For the most part these errors are avoidable when we have the opportunity to study the patient carefully.

SHOCK AND HÆMORRHAGE: AN EXPERIMENTAL STUDY

By FRANK C. MANN, M.D., Rochester, Minnesota
From the Mayo Clinic

THE experimental study of the phenomena termed "surgical shock" is difficult because what constitutes shock has never been very clearly defined. This has led to many conflicting data and diverse theories. It is necessary, therefore, to define carefully what is meant by "surgical shock" and to prescribe the limits of its clinical application.

In a previous article (1) I have outlined the experimental conditions under which could be made a study of the symptom complex of post-operative shock. In order to give definite value to the work, two factors have been closely observed: (1) a uniform method of producing shock; and (2) the reduction of the animal to the condition of shock as defined in my previous study of the subject; i.e., (*a*) great loss of sensibility, (*b*) pallor of mucous membranes, (*c*) small, weak pulse, (*d*) irregular, rapid, shallow, or gasping respiration, and (*e*) materially lowered blood pressure.

In regard to the first factor, I have pointed out the impracticability of attempting to produce by traumatizing nerve-trunks, joints, etc., the condition in which the clinical signs of shock are present. The only uniform method of producing shock experimentally is to open the abdomen and expose the viscera. It is obvious that only the condition known as post-operative shock can be the subject of experimental investigation. Psychic shock and the use of the term as applied to railway accidents are not subjects for experimental observation, and it is futile to seek a common cause for all these varied manifestations.

All my data on shock have been secured from experiments on animals in which the clinical signs, as enumerated, appeared when the viscera were exposed. These results are comparable with those obtained by other experimental observers inasmuch as most observers have produced shock by visceral traumatization. Clinically my results may be applied to the shock produced during operation.

It is generally conceded by clinical and experimental investigators that shock is in some manner associated with circulatory failure, due either to a cardiac or vasomotor

impairment. In either case overstimulation of the nervous system has been considered the cause of this profound depression of the circulation. Numerous experiments have established the fact that the heart is not primarily impaired in shock but is able to do its work efficiently if enough blood is returned to it. It has been almost as conclusively proved that the vasomotor center is not fatigued or exhausted. On the contrary, this center is probably in a state of hyperirritability until the condition is moribund and is vainly striving to maintain blood pressure at its normal level.

Henderson (2) has pointed out that stagnation of the circulation does not necessarily mean cardiac or vasomotor failure. He emphasizes the fact that it is the function of the heart to pump and the function of the vasomotor system to regulate peripheral resistance. Given a sufficient amount of blood, equilibrium is preserved, and these two factors are able to maintain a normal blood pressure. However, at a point of its cycle distal to the arterioles in the capillaries and venous reservoirs, the blood encounters a place where it is more or less beyond the control of the heart and vasomotor system and another factor becomes essential to the maintenance of effective circulation: a mechanism which will return the blood from the capillaries to the heart. An impairment of some part of this mechanism can produce a failure of circulation despite an effective pump and vasomotor system. Henderson believes this mechanism to be injured in shock by loss of carbon dioxid. This causes the walls of the veins to lose tone and the tissues to undergo changes whereby they imbibe more water from the blood and thus diminish the amount of circulating fluid.

As the result of a previous investigation I concluded that shock produced by the exposure of the abdominal viscera was due to a loss of circulatory fluid, the causes for this loss probably being the same as those producing the stasis which pathologists consider as part of the process of inflammation.

The problem at hand was to determine whether there is in shock an actual loss of circulating fluid and, if so, whether the loss can be accounted for simply by vasomotor failure. In a measure the problem has been solved by Lyon and Swarts (3), who found that the percentage of blood was decreased in all organs after shock.

The amount of blood that can be obtained from a large arterial trunk — as the femoral — is the measure of efficient blood; it is the amount which can be returned to the heart and lungs and, after aëration, be pumped out to feed the tissues. The blood which can be secured from the venous side of the circulatory system — as from the right auricle — is the amount that is freely movable but was not returned to the arterial system. Their sum is the amount of mobile blood in the body. This sum subtracted from the total amount of blood gives the quantity of immobilized blood; the fixed quantity in the tissues. So far as the immediate circulatory needs of the organism are concerned, this latter amount of blood is useless.

In my experiments the total amount of blood was estimated in its relation to the body weight. The percentage used was 7.7 per cent, or one-thirteenth of the total weight of the animal. This standard is open to a certain degree of error, particularly since it was impossible to obtain enough dogs of approximately the same size and breed. However, this source of error was reduced to a minimum by using in each series the same type of animals in the same physical condition and, as the study is of comparative conditions, the variation does not materially affect averages.

The general technique was uniform in all the experiments. The animal, which had been fasted for eighteen hours, was etherized and carefully weighed. The anæsthesia was maintained by the auto-intratracheal inhalation method (4). Blood pressure was taken from the right carotid artery. A cannula was placed in the right femoral artery. After performing the experimental procedure, such as producing shock, sectioning the spinal cord, etc., the femoral artery was opened and all the blood that could be secured was obtained. The thorax was then opened, the pericardium stripped over the heart, and, turning the animal on its side in a slight

TABLE I

Experiments	Number of Experiments	Body Weight of Animal	Weight of Blood Obtained from Right Femoral Artery	Weight of Blood Obtained from Right Auricle and Cava	Total Amount of Blood Obtained	Estimated Total Amount of Blood on the Basis of 7.7 per cent of Body Weight	Amount of Blood Left in Tissues	Percentage of Blood Obtained from Femoral Artery	Percentage of Blood Obtained from Right Auricle	Total Percentage of Blood Obtained	Percentage Left in Tissue	Normal Blood Pressure	Blood Pressure at Time of Hæmorrhage
Series of normal animals.	3	9,952	506	60	566	766	200	66	8	74	26	125	125
	4	11,000	600	95	695	847	152	71	11	82	18	120	120
	5	10,450	600	100	700	804	134	70	12	83	17	130	125
	13	9,330	476	60	536	718	182	66	8	75	25	145	145
	15	13,933	685	105	790	1,072	282	64	10	74	26	130	130
	33	8,708	400	70	470	670	200	60	10	70	30	150	150
Average								66	10	76	24		
Series in which the cervical cord was sectioned	7	9,071	345	85	430	698	268	49	12	62	38	150	100
	8	10,947	400	90	490	842	352	47	11	58	42	125	65
	9	24,383	990	195	1,185	1,876	691	54	10	64	36	150	100
	11	11,072	550	100	650	852	202	65	12	76	24	145	100
	12	9,206	380	95	475	708	223	54	12	66	34	155	75
	35	13,425	600	120	720	1,033	313	58	12	70	30	140	78
Average								54	11	66	34		
Series in which ether was pushed until respiratory failure	10	22,890	700	210	910	1,761	851	40	12	52	48	130	0
	14	15,923	660	130	790	1,225	311	53	11	64	36	120	0
	17	14,928	475	160	635	1,148	513	42	14	55	45	130	10
	26	16,918	625	200	825	1,301	476	48	15	63	37	128	0
	27	15,177	575	155	730	1,167	437	48	13	62	38	102	0
	34	4,353	150	42	192	335	143	45	13	57	43	120	5
Average								46	13	59	41		
Series in which shock was produced by exposure of the abdominal viscera	6	8,459	176	74	250	651	401	27	11	38	62	147	40
	18	10,947	260	90	350	842	492	31	11	42	58	122	70
	20	6,220	145	55	200	478	278	30	11	42	58	124	50
	24	10,201	250	85	335	785	350	32	11	43	57	108	50
	28	7,962	150	75	225	612	387	24	12	37	63	105	50
	36	13,933	250	105	365	1,072	707	23	11	34	66	140	70
Average								28	11	39	61		
Experiments in which the viscera were exposed but complete shock was not allowed to develop	19	13,186	390	95	485	1,014	529	38	9	48	52	150	90
	23	7,713	215	85	300	592	293	36	14	51	49	105	65
Experiment in which the splanchna had been sectioned just above diaphragm seven days previously	21	12,938	475	150	625	995	370	49	15	64	36	134	130
Experiment in which the spinal cord from sixth cervical segment peripherally was completely destroyed	25	7,464	250	85	335	574	239	42	15	57	43	120	0
Experiment in which, after producing shock, blood pressure was increased by injection of adrenalin	29	5,971	175	35	210	459	249	38	8	46	54	110	180
Experiment in which the vasomotor center was tested after hæmorrhage	30	10,450	(1)295 (2)200	130	625	804	123	62	16	78	22	95	(1)150 (2)45
Experiment in which curare was given until respiration had almost ceased	31	21,521	1,000	335	1,335	1,655	320	60	20	81	19	140	158
Experiment in which abdomen was widely opened just before bleeding	37	7,091	430	40	470	545	75	79	7	86	14	115	125
Experiment in which the bleeding was preceded by a slow hæmorrhage of 36 per cent of the animal's blood	38	83,348	(1)275 (2)140	50	465	641	176	65	8	73	28	130	45
Experiment in which the cervical cord was sectioned two hours before bleeding.	41	16,918	675	145	820	1,301	481	52	11	63	37	145	75

TABLE II

Experiments	Percentage Obtained from Femoral Artery	Percentage Obtained from Right Auricle and Cava	Total Percentage Obtained	Percentage Left in the Tissue
Series of normal animals	66	10	76	24
Series in which the cervical cord was sectioned	54	11	69	34
Series in which ether was pushed until respiratory failure	46	13	59	41
Series in which shock was produced by exposure of abdominal viscera	28	11	30	61
Experiment in which the spinal cord from sixth cervical segment peripherally was destroyed	42	15	57	43
Experiment in which, after the production of shock, adrenalin was given and the animal bled when blood pressure had reached its highest point	38	8	46	54

Trendelenburg position, the right auricle and, later, the cava were opened, allowing the blood to flow into a wide-mouthed receiver. The exact weight of the separate specimens was recorded.

The observations fall into four different groups: (1) In the first series normal dogs were used as controls to determine how much blood can be obtained by the method described; (2) in the second series the cervical cord was cut before bleeding; (3) in the third series the animals were practically killed with ether and the bleeding was done after the institution of artificial respiration; (4) in the fourth series the animals were shocked by exposure of the abdominal viscera. Several special experiments devised to emphasize certain points are also reported. (Table I, Detailed observations; Table II, Condensed data.)

In the first series the blood pressure was taken with the normal animal in a moderate depth of etherization and then the bleeding from the femoral artery was started. From these animals we obtained an average of 66 per cent of the blood from the femoral artery, 10 per cent from the heart, making a total of 76 per cent obtained and leaving 24 per cent in the tissues. These results are a fair average for the experimental conditions under which they were secured and form the standard of comparison for the results of all the other experiments. The following is a representative protocol:

Experiment 13. March 6, 1915. Dog; rather poor brindle bull; weight 9,330 gms. The animal was etherized; carotid blood pressure taken and a cannula placed in the right femoral artery. Normal blood pressure 145. From the femoral artery 476 gms. of blood were obtained and 60 gms. from the right auricle. The estimated total amount of blood was 717 gms. From the femoral artery 66.3 per cent was recovered and 8.3 per cent from the heart, making a total of 75 per cent obtained and leaving 25 per cent of the blood in the tissues (Fig. 1).

In the second series the cervical cord, usually the sixth or seventh segment, was sectioned before the bleeding. As this severs practically all the vasoconstrictor fibers from their connection with the medullary center, the procedure simulates as nearly as possible a total paralysis of the medullary vasomotor center. The fall in blood pressure induced by this operation approached that observed in shock in but a minority of cases. It should be borne in mind that even with the most careful hæmostasis some blood was lost during the operation. The blood pressure was allowed to reach a constant level before the bleeding was started. From these animals an average of 55 per cent of blood was obtained from the femoral artery and 11 per cent from the heart, making a total of 66 per cent recovered and leaving 34 per cent in the tissues. It is thus seen that after removal of the influence of the medullary vasomotor center an increase of 10 per cent of blood remained in the tissues. The following protocol is a good example of this series:

Experiment 9. March 5, 1915. Dog; brown and white male mongrel; weight 24,383 gms.

9:45 a.m.: Etherized; carotid blood pressure taken; cannula placed in femoral artery. 9:55 a.m.: Pulse 158; respiration 36; blood pressure 150. 10:07 a.m.: Incision made for exposing spinal cord. 10:27 a.m.: Cord sectioned (seventh cervical segment); blood pressure fell to 100. 10:40 a.m.:

Bled from the femoral, obtaining 990 gms. of blood; 195 gms. obtained from the heart. The estimated amount of blood was 1,875 gms.; 54 per cent was obtained from the artery and 10 per cent from the heart, making a total of 64 and leaving 36 per cent in the tissues.

In order to test the effect that blood pressure might have upon the quantity of blood obtained, a complete failure of respiration and a more or less complete vasomotor paralysis by overetherization were produced in a third series of experiments. After taking the normal blood pressure in these animals, ether was pushed to the point of respiratory failure. When the blood pressure had practically reached zero and no pulsation could be felt in the femoral artery, artificial respiration was instituted by means of alternate thoracic and abdominal compression and the bleeding was started. Spontaneous respiratory movements returned in but one experiment, and in this case they were of the convulsive type. It usually required about twice as long to obtain all the blood in animals of this series as in the controls. I was very much surprised to find that under such conditions an average of 46 per cent of blood could be obtained from the femoral artery, 13 per cent from the heart, leaving 41 per cent in the tissues. In these animals there was an average increase of 17 per cent of blood left in the tissues as compared with the amount in normal animals. Experiment 26 is a typical experiment:

Experiment 26. March 11, 1915. Dog; male shepherd; weight 16,918 gms.

3:40 p.m.: Etherized. Apparatus arranged to record carotid blood pressure. Cannula placed in right femoral artery. 3:50 p.m.: Pulse 140; respiration 22; blood pressure 128. 3:52 p.m.: Began to push ether. 3:56 p.m.: Respiration failed. 3:59 p.m.: Blood pressure reached zero; no pulsation in femoral artery. Femoral artery opened; thoracic and abdominal compression started. From the right femoral artery 625 gms. of blood were secured, 200 gms. from the heart. The estimated amount of blood was 1,301 gms. This makes 48 per cent from the artery, 15 per cent from the heart, a total of 53 per cent, leaving 37 per cent in the tissues (Fig. 3).

In the fourth series of experiments, after obtaining the normal blood pressure the right vagus was sectioned and the central end stimulated for the purpose of testing the response of the vasomotor center to reflex stimulation. Two such tests of the vasomotor center were made before the abdomen was widely opened and the viscera exposed. When the resulting condition fulfilled all the clinical requirements for shock, the response of the vasomotor center was tested a third time. In every case the response was practically the same in the shocked condition as in the control. After this procedure the animal was bled. None of these experiments produced a very low blood pressure and the reaction of the vasomotor center was normal. An average of only 28 per cent of blood was obtained from the femoral artery, 11 per cent from the heart, making a total of 39 per cent obtained, leaving 61 per cent in the tissues. This means that in these animals less than 40 per cent of the blood was available and that almost 37 per cent more than the normal amount was stagnated in the tissues. Such a loss of circulating fluid is sufficient to produce all the accompanying clinical signs of shock. Experiment 18 is typical:

Experiment 18. March 8, 1915. Dog; weight 10,947 gms. 9:45 a.m.: Etherized. Apparatus arranged to record carotid pressure and to bleed from femoral artery. Right vagus exposed. 9:15 a.m.: Pulse 130; respiration 42; blood pressure 122. 9:18 a.m.: Sectioned right vagus. Slight rise in blood pressure. 9:43 a.m.: Stimulated central end right vagus for 10 seconds. Blood pressure increased 30. 9:45 a.m.: Stimulated central end right vagus. Blood pressure increased 55. 9:50 a.m.: Abdomen opened and viscera exposed; blood pressure gradually fell. 1:00 p.m.: Animal has all the signs of shock. Has had no ether since 12:05; eye reflex positive; pulse 122, weak; respiration 18; gasping; blood pressure 70. 1:01 p.m.: Stimulated central end right vagus 10 seconds. Blood pressure increased 36. 1:04 p.m.: Stimulated central end of vagus 20 seconds. Blood pressure increased 40. 1:05 p.m.: Blood pressure 70. Bled from femoral artery 260 gms. and 90 gms. from the heart. Estimated amount of blood was 842; 31 per cent was recovered from artery, 11 from the heart, making a total of 42 per cent and leaving 58 per cent in the tissues (Fig. 4).

These experiments seem to prove that the reason for the common symptoms of shock and hæmorrhage is that they have a common pathology. In shock a large percentage of blood is as effectually lost from the circula-

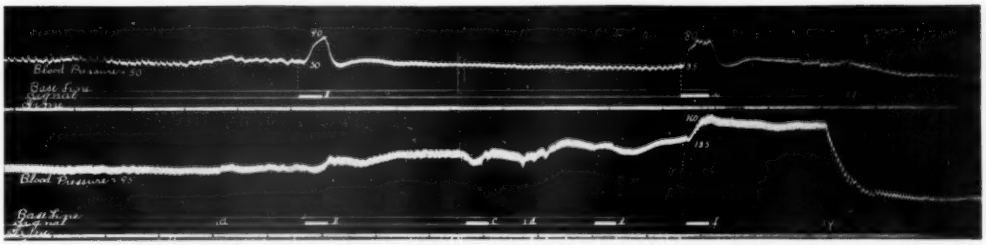

Fig. 1 (*Experiment 13*). Normal blood pressure 95. Right and left vagus sectioned at *a* and *d*, respectively. At *b*, *c*, *e*, and *h* central end of right vagus stimulated. Central end of left vagus stimulated at *f* and *i*. At *g* the animal was bled 37 per cent of its blood. At *j* it was bled to death. Note the reaction of vasomotor center after hæmorrhage.

tion as if it had escaped by a free hæmorrhage. That this decrease in the amount of circulating blood is essentially different from the venous congestion produced by paralysis of the medullary vasomotor center is shown by a comparison between the amount of blood left in the tissues after section of the cervical cord and that after the production of shock. In the former condition there is only 10 per cent more blood left in the tissues than in the control, while in the latter there is a surplus of 37 per cent stagnated in the tissues.

However, these experiments do not preclude the possibility of the production of splanchnic paralysis by an inhibition of the cord-centers, as held by Janeway and Ewing (5). While it is true that vasomotor reflexes involving the cord-centers take place during shock, the following experiments show that the centers are not fatigued and that complete vasomotor paralysis does not produce immobilization of the blood. That the centers are active was shown by Experiment 125:

Experiment 125. February 20, 1914. Cat, female. Etherized. Blood pressure 98. Dorsal cord exposed and first segment sectioned; blood pressure fell until it reached a constant level of 70. Abdomen was then opened and viscera exposed. Blood pressure fell rather quickly to 42. When blood pressure was 14 and the animal in marked shock, a small probe was passed peripherally in the spinal canal, compressing the cord. Blood pressure quickly increased to 52.

That total destruction of the central vasomotor system does not produce the immobilization of the blood found in shock is shown by the following experiment:

Experiment 25. March 11, 1915. Dog; small brown female cur; weight 7,464 gms.

8:50 a.m.: Etherized. Apparatus arranged to record carotid blood pressure and a cannula placed in the femoral artery. 9:00 a.m.: Pulse 150; respiration 20; blood pressure 120. 9:05 a.m.: Incision made to expose cervical cord. Cord laid bare; slight hæmorrhage. 9:20 a.m.: Ligature passed around cord. 9:22 a.m.: Cord sectioned at sixth cervical segment; blood pressure 94. 9:35 a.m.: Cord exposed in lower lumbar region. 9:50 a.m.: Probe passed from cervical opening peripherally. Some little difficulty was experienced in keeping probe in canal. However, the entire cord

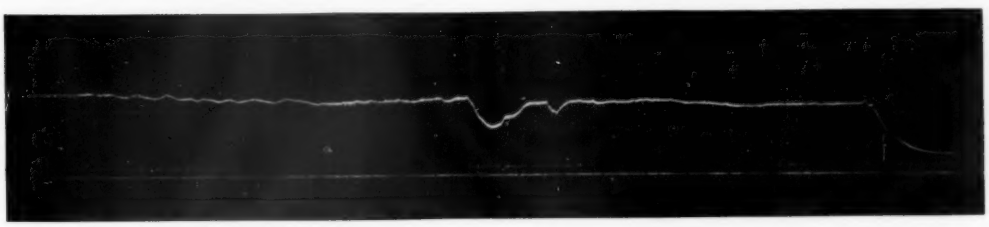

Fig. 2 (*Experiment 11*). Normal blood pressure 145. Marked fall in pressure when ligature was passed around cord. After section of sixth cervical segment blood pressure remained at 100; 65 per cent of blood secured from femoral artery and 12 from heart.

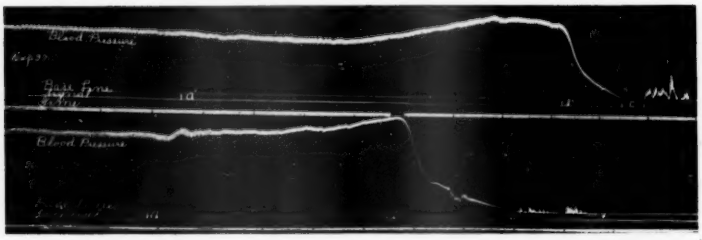

Fig. 3 (*Experiment 26*). Normal blood pressure 128. Began to push ether at *a*. Respiration failed at *b*. Femoral artery was opened and artificial respiration started at *c*. Obtained 48 per cent of blood from artery and 15 from heart. (*Experiment 27*). Normal blood pressure 102. Signals a', b', and c' signify same as in Experiment 26. Obtained 48 per cent of blood from artery and 13 from heart.

was finally destroyed from cervical opening to lumbar opening. There was some hæmorrhage. At first the blood pressure was not markedly affected but the respiration became irregular and the blood pressure finally fell to zero. 10:20 a.m.: Animal bled. Secured 250 gms. of blood from femoral artery and 85 gms. from heart. The estimated amount of blood was 574 gms.; 42 per cent was obtained from the artery, 15 per cent from the heart, making a total of 57 per cent and leaving 43 per cent in the tissues.

That loss of vasomotor tone with splanchnic congestion for the length of time necessary to produce shock does not give rise to identical conditions is shown by Experiment 41:

Experiment 41. March 29, 1915. Dog, male shepherd; weight 16,918 gms. 8:45 a.m.: Etherized. Apparatus arranged to record carotid blood pressure. Cannula placed in femoral artery. 9:04 a.m.: Blood pressure 145. 9:06 a.m.: Incision made to expose cervical cord. 9:12 a.m.: Passed ligature around cord. 9:18 a.m.: Cord sectioned at sixth cervical segment; slight hæmorrhage. Blood pressure fell to 60. Animal was kept lightly etherized until 11:50. Blood pressure at this time was 75. Femoral artery was opened, obtaining 675 gms. of blood; 145 gms. were obtained from the heart. The estimated amount of blood was 1,301 gms.; 52 per cent was secured from artery and 11 per cent from the heart, making a total of 63 per cent and leaving 37 per cent in the tissues. This is practically the same result as in the cord series (Fig. 5).

The following experiment shows that the immobilization of the blood in shock takes place beyond the control of the vasomotor system. This experiment also emphasizes the fact that the amount of blood obtained is not primarily dependent upon blood pressure.

Experiment 29. March 12, 1915. Dog, young brown female spaniel. Weight 5,971 gms. 2:50 p.m.: Etherized. Carotid blood pressure taken. Cannula placed in right femoral artery; left femoral vein exposed. 3:00 p.m.: Pulse 132; respiration 18; blood pressure 110. 3:13 p.m.: Abdomen opened; viscera exposed. Marked fall of blood pressure which quickly recovered and was followed by a gradual fall. 4:20 a.m.: Animal in moderate degree of shock; has needed no ether since 4:00. Eye reflex positive; blood pressure 50. 4:23 a.m.: Injected 2 ccm. of adrenalin (1–1000) into femoral vein; blood pressure increased from 50 to 180. 4:24 a.m.: When blood pressure had reached highest

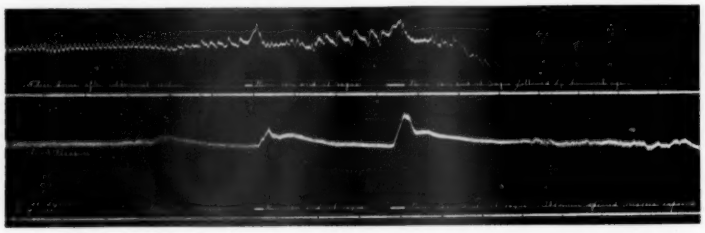

Fig. 4 (*Experiment 18*). Normal blood pressure 122. After exposing viscera for three hours it had decreased to 70. Reaction of vasomotor center practically normal. Obtained 31 per cent of blood from artery and 11 from heart.

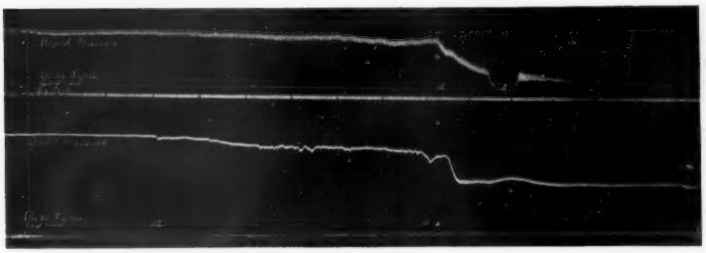

Fig. 5 (*Experiment 41*). Normal blood pressure 145. Cervical cord exposed between *a* and *b*. Fall in blood pressure due to passing ligature around cord. Cord sectioned at sixth cervical segment at *c*. Blood pressure fell to 60 but after 2.5 hours increased to 75 when the femoral artery was opened (*d*). Obtained 52 per cent of blood from artery and 11 from heart.

point, the femoral artery was opened. Obtained 175 gms. of blood from artery, 35 gms. from the heart. The estimated amount of blood was 459 gms., of which 38 per cent was secured from the artery and 8 per cent from the heart, making a total of 46 per cent, leaving 54 per cent in the tissues. The maximum constriction of the arterioles in shock with an increase of blood pressure far above normal did not materially increase the amount of mobile blood as compared with the average of the shock series (Fig. 6).

The following experiments show that considerable blood can be lost in both shock and hæmorrhage and still a relatively high blood pressure be maintained. The parallelism of the two conditions and the activity of the vasomotor system are again presented.

Experiment 30. March 13, 1915. Dog, black, white, and yellow female mongrel; weight 10,450 gms. 9:15 a.m.: Etherized. Apparatus arranged to record carotid blood pressure and to bleed from femoral artery. Both vagi exposed. 9:30 a.m.: Pulse 170; respiration 26; blood pressure 95. 9:34 a.m.: Right vagus cut; slight rise in blood pressure. 9:35 a.m.: Stimulated central end right vagus; respiration ceased; slight rise in blood pressure. 9:38 a.m.: Repeated stimulation; same result. 9:40 a.m.: Sectioned left vagus. 9:41 a.m.: Stimulated central end right vagus; slight increase in blood pressure. 9:42 a.m.: Stimulated central end of left vagus; blood pressure increased 35. 9:44 a.m.: Blood pressure 150. Bled 295 gms. (approximately 36.7 per cent) from femoral artery. Blood pressure fell to 35 and then gradually increased to 50. 10:00 a.m.: Animal exhibited the signs of shock. Stimulated central end right vagus; blood pressure increased 40. 10:06 a.m.: Stimulated central end left vagus; blood pressure increased 45. 10:08 a.m.: Bled from femoral artery, obtaining 200 gms. of blood and 130 gms. from heart. Estimated amount of blood was 810; 61 per cent was the total amount from artery, 16 per cent from heart, making 77 per cent, leaving 23 per cent in the tissues.

The above experiment proves that a free hæmorrhage of 36.7 per cent of an animal's blood, which is the average found to be lost in the shock series, will produce all the clinical signs of shock and, furthermore, the vasomotor center response to reflex stimulation is identical in shock and in a hæmorrhage of this degree. A further comparison of these two experiments shows that shock and hæmorrhage have a common cause.

Experiment 19. March 8, 1915. Dog; male; white mongrel; weight 13,186 gms.

3:30 p.m.: Etherized. Apparatus arranged to record carotid blood pressure and to bleed from femoral artery. Right vagus exposed. 3:40 p.m.: Pulse 220; respiration 42; blood pressure 150. 3:50 p.m.: Sectioned right vagus. 3:55 p.m.:

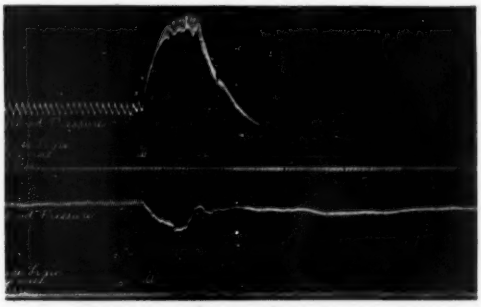

Fig. 6 (*Experiment 29*). Normal blood pressure 110. Abdomen opened at *a*. When animal was in shock with blood pressure of 50, 2 ccm. adrenalin was injected (*b*). Femoral artery opened at *c*. Obtained 38 per cent from artery and 8 from heart.

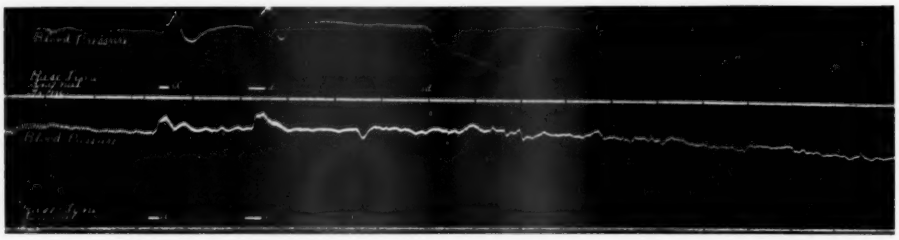

Fig. 7 (*Experiment 19*). Normal blood pressure 150. Signals *a* and *b*; *a'* and *b'* mark point of stimulation of central end right vagus. Abdomen opened at *c*. After exposure of viscera blood pressure fell to 90 and animal did not exhibit all the signs of shock. Note reaction of vasomotor center; 38 per cent of blood secured from artery and 9 from heart.

Stimulated central end right vagus; blood pressure increased 30. 3:56 p.m.: Again stimulated central end of vagus; same result. 3:57 p.m.: Abdomen opened; viscera exposed; blood pressure gradually fell but animal did not develop all the signs of shock. 6:00 p.m.: Animal still requires an anæsthetic. Blood pressure 85. 6:05 p.m.: Stimulated central end of right vagus; blood pressure rose 4. 6:06 p.m.: Repeated stimulation; identical result. 6:12 p.m.: Blood pressure 90. Bled, obtaining 390 gms. of blood from artery and 95 gms. from heart. The estimated amount of blood was 1,014 gms.; 38.4 per cent was secured from the artery and 9.3 from the heart, making a total of 48 per cent, and leaving 52 per cent in the tissues. This animal had lost physiologically 28 per cent of its blood and yet maintained a blood pressure of 90 and did not develop all the signs of shock (Fig. 7).

Experiment 38. March 26, 1915. Dog; weight 8,334 gms. 9:45 a.m.: Etherized. Carotid blood pressure taken. Cannula placed in right femoral artery and left femoral vein. 10:07 a.m.: Blood pressure 130. 10:10 a.m.: Bled slowly 165 gms. (about 26 per cent) from femoral vein. Blood pressure remained at 110. Animal did not show signs of shock. 10:54 a.m.: Blood pressure 110; ether still necessary. Bled 64 gms. of blood from vein when cannula blocked by clot. Blood pressure 99. The left femoral artery was then opened and 46 gms. (about 7 per cent) obtained. Bleeding 229 gms. (about 36 per cent) of blood slowly from the femoral vein decreased blood pressure 31. Bleeding 46 gms. (about 7 per cent) from femoral artery decreased blood pressure 45. 12:00 a.m.: Animal exhibited signs of shock; bled 140 gms. from artery and 50 gms. from heart. The estimated amount of blood was 642. A total of 65 per cent was secured from artery and vein, 8 per cent from the heart, making a total of 73 per cent, leaving 27 per cent in the tissues (Fig. 8).

Gatch (6) has shown that the abdominal wall is an important factor in the maintenance of the most efficient mechanism for the return of the blood to the heart. The bearing that this factor might have on the above method of investigation was tested in these experiments:

Experiment 31. The animal was given curare until respiratory movements had almost ceased, thus eliminating the effect of abdominal tone before bleeding.

Experiment 37. The abdomen was widely opened just before bleeding was commenced.

In both these experiments the amount of blood secured was within the normal limits, showing that this factor did not complicate the results.

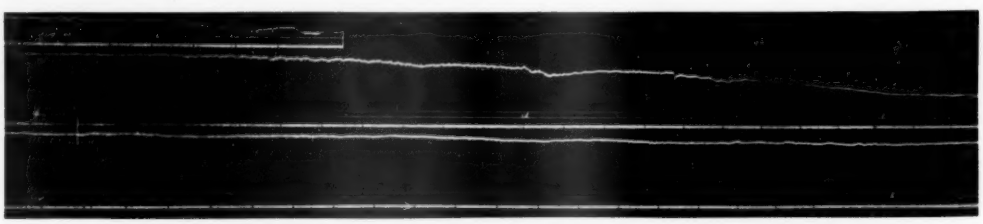

Fig. 8 (*Experiment 38*). Normal blood pressure 130. Between *a* and *b* 26 per cent of the blood of the animal was removed by slow hæmorrhage from femoral vein. Blood pressure decreased to 110. Between *c* and *d* 10 per cent more was removed. Between *d* and *e* bled 7 per cent from femoral artery. At *f* bled to death from femoral artery.

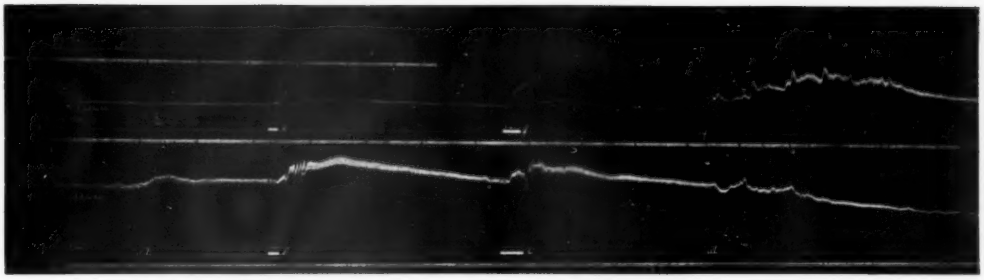

Fig. 9 (*Experiment 32*). Normal blood pressure 100. Right vagus cut at *a*. Central end stimulated at *b* and *c*. Abdomen opened at *d*. Blood pressure decreased to 30. Animal in deep shock when vagus was again stimulated at *e* and *f*. Note reaction of vasomotor center. At *g* injected 240 gms. of citrated blood (equal to about 35 per cent of the animal's blood). Blood pressure at first increased, but in 30 minutes was only 64. Bled at *h*, obtaining 385 gms. from artery and 63 from heart.

Other experiments, as section of the splanchnic nerves, transfusion of blood, etc. (Table I, Fig. 9), further emphasized that there is a decrease in blood in shock and that this is not due to a primary failure of the vasomotor mechanism.

SUMMARY OF EXPERIMENTS

The data from the experiments herewith reported may be summarized as follows:

1. In a normal dog 66 per cent of the blood can be obtained from the femoral artery and 10 per cent from the heart, making a total of 76 per cent which can be secured, leaving 24 per cent in the tissues.

2. In an animal in which the cervical cord is sectioned, producing medullary vasomotor paralysis, 54 per cent of the blood can be obtained from the femoral artery and 12 per cent from the heart, a total of 66 per cent, leaving 34 per cent in the tissues.

3. In an animal in which blood pressure is depressed practically to zero by an overdose of ether, 46 per cent of the blood can be obtained from the femoral artery and 13 per cent from the heart, making a total of 59 per cent, leaving 41 per cent in the tissues.

4. In an animal in which the viscera have been exposed until the clinical signs of shock are present but in which the vasomotor reflexes are as active or even more so than in the normal condition, only 28 per cent of the blood can be obtained from the femoral artery and 11 per cent from the heart, making a total of 39 per cent, leaving 61 per cent in the tissues.

CONCLUSIONS

The clinical signs of shock which appear after section of the abdomen and exposure of the viscera are due to a loss of circulatory fluid. This loss of fluid is not dependent upon any primary impairment of the medullary vasomotor center and takes place at a point beyond the control of the vasomotor mechanism. The causes for this loss of fluid are apparently the same as those which determine the accumulation of fluid in any other irritated area and produce the signs of inflammation. The nervous system probably plays no greater part in the former case than in the latter. The condition is made grave when the viscera are exposed because of the great vascularity of the tissues involved.

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ADDENDA

BY JOSEPH C. BLOODGOOD, M.D., F.A.C.S., BALTIMORE

In *Progressive Medicine* for December, 1914 (p. 169), I critically reviewed the contribution of Frank C. Mann[1] on "The Peripheral Origin of Surgical Shock." On December 8, 1914, Dr. Mann wrote me as follows: "Your review of my article contains one criticism which I should like to answer by submitting further data and one misquotation to which, I am sure, your attention only needs to be called to secure its correction."

First, as to the correction: On page 170 of *Progressive Medicine* for December, 1914, I quoted from page 212 of Mann's article, his sixth conclusion. My quotation was as follows: "It is *impossible* to produce signs of shock by the use of excessive heat or cold." The quotation should have read: "It is *possible*, etc."

On page 171 (*ibid.*) in quoting Mann's tenth conclusion I called attention to the discrepancy in his sixth conclusion. This mistake is mine.

Dr. Mann further writes that on page 172 (*ibid.*) I wrote as follows: "In this paper the details of Mann's experiments are not given, so that it is impossible to study critically the methods of his investigation."

Dr. Mann in his letter of December 8 tells me that in the original manuscript submitted to the Dean of the Medical Department of the University of Indiana, the experiments were given in detail, but that the editor of the *Johns Hopkins Hospital Bulletin* was of the opinion that it was not necessary to publish them.

This criticism of mine, of course, amounted to very little. It simply meant that from the standpoint of pure physiology one would have been unable to follow Mann's experiments in the laboratory. The omission, however, cannot be blamed on Dr. Mann. Similar experiments are described in detail in Dr. Mann's paper in this issue.

Dr. Mann further writes: "Concerning your other criticisms I must continue to regard them in the light of personal opinion until more data are submitted. I should like to point out, however, that the conclusions of Janeway and Ewing are only slightly different from my own."

This experimental work of Mann was performed under the direction of Dr. W. D. Gatch, Professor of Surgery of the Indiana University.

Dr. Gatch also wrote me about my critical review in *Progressive Medicine:* "I was deeply interested as well as greatly surprised at your review of Dr. Mann's article. I believe that if you had read the article more carefully instead of considering the conclusions entirely apart from the context, you would have agreed with most of the conclusions."

Dr. Gatch writes as follows about Dr. Mann's first conclusion, with which I differed in my critical review: "It is impossible to reduce the anæsthetized animal to a state of shock by any degree of sensory stimulation providing all hæmorrhage is prevented and its abdomen not opened."

Bloodgood's criticism: "In my experience with operative surgery under general anæsthesia in which the condition of the patient has been most carefully recorded and the blood-pressure changes estimated during the entire operation, I have observed extreme degrees of shock in operations other than on the abdomen, even though there had been no hæmorrhage; for example, during operation for old, badly united fractures of the shaft of the femur. In these cases the only factors which could have produced shock were the painful stripping of the periosteum and the extreme extension of the limb."

Dr. Gatch remarks: "In regard to the first conclusion, this is not new; in fact, Porter demonstrated it years ago. Mann demonstrated it beyond a shadow of doubt on fourteen dogs. In all of his cases the most extensive traumatization of the extremities was done, all four limbs being amputated and the limbs avulsed with as much roughness as possible. The skin was burned, the skull-cap lifted, and the dura cauterized. All of these manipulations were carried out within a period from four to six hours. The animals' blood-pressure and respirations would show no change from that at the beginning of the experiments,[2] being in as good condition as at the beginning. Of course, the most scrupulous care was taken to prevent hæmorrhage. It is interesting that in two cases in this series in which the signs of shock were developed, we found in one case a large intra-abdominal hæmorrhage and in the other an enormous hæmorrhage in the legs from fractured bones."

In my criticism, as noted above, of Mann's first conclusion I simply made the statement that my own clinical experience upon the human being could not confirm Mann's first conclusion.

I am not in a position to confirm or controvert Mann's experimental observations. I gather the impression, however, from what Dr. Gatch writes me of Dr. Mann's experience that this experimental work should rank with the best that has been done in the various experimental and physiological laboratories. But the very best experimental physiologists have come to different conclusions and apparently from data gathered from experiments as much alike as it is possible for the different experimenters to make them.

I feel that I must again record my disagreement with Mann's first conclusion based upon the evidence of his experimental work. It may be true for dogs, but it is apparently not true for the human being.

[1] Johns Hopkins Hosp. Bull., 1914, xxv, 205.

[2] Dr. Mann writes me that all these experiments were done under ether and chloroform anæsthesia.

I have observed extreme degrees of shock in operations in which the abdomen of the human patient had not been opened and in which there had been no hæmorrhage; that is, these patients have shown the same low blood-pressure and the same symptoms which have been called shock when observed in operations upon the abdomen. I am also sure that the great majority of surgeons will agree with me.

My criticism, therefore, is not of Mann's experimental work, nor of his conclusions from the evidence of this laboratory investigation. I called attention to this conclusion, because I feared that it might create the impression that trauma in operations other than upon the abdomen was not an important factor in shock.

It is quite true that the same degree of shock experienced in operations on the abdomen is apparently much more serious than when observed in operations without the abdomen. It is also true, from my operative observations, that the prognosis of shock not associated with hæmorrhage is as a rule much better than of shock associated with hæmorrhage.

Among my records there is an anæsthetic chart which portrays an extreme degree of shock apparently due to an overdose of ether only; then a second chart recorded during a shoulder-girdle amputation in which there was practically no hæmorrhage. The only etiological factors for the shock were ether anæsthesia and trauma.

The difference of opinion, therefore, between Dr. Mann and myself is that my clinical observations do not confirm his first conclusion.

It is fortunate, however, that Dr. Mann has taken up this physiological problem, because there have never been enough well-trained workers interested in it.

Dr. Gatch remarks: "In regard to the observation of shock during the operation (upon the human being) there are so many causes by which the signs of shock can be produced, and the term is used so loosely, that I have found it impossible nearly always to say just what was at fault in a given case. My belief is that the depth of narcosis has more to do with it than any other single factor. My reasons for this are set forth at length in a paper[1] entitled 'The Effect of Laparotomy upon the Circulation' and also in a paper soon to appear in the *American Journal of Surgery* on 'The Proper Depth of Narcosis.' Mann discusses this point at the beginning of his article, and I am in complete accord with his conclusions that the word *shock* is used almost as vaguely as the word *rheumatism*. The gist of Mann's article is that shock and hæmorrhage are practically identical, that experimental shock is simply due to an extensive extravasation of the elements of blood into the peritoneal tissues, that this change is due to a traumatic inflammation and that the central nervous system has little to do with the condition. Of course, we should use the most extreme care in handling the abdominal viscera. This is not from the danger of nervous stimuli acting upon the central nervous system, but from the danger of traumatic inflammation in the peritoneal cavity."

[1] Tr. Am. Gynec. Soc., 1914.

Mann's conclusion 4: "The vasomotor center is not depressed nor fatigued. It is the most resistant of all vital centers. The peripheral and untraumatized visceral arteries are constricted in shock."

Bloodgood's criticism: "This must be a very difficult thing to prove or disprove. Crile has always favored the theory of fatigue or exhaustion, Meltzer inhibition, while Howell, from his experiments, is of the opinion that there is more than one factor influencing this center. Apparently from the standpoint of pure physiology the exact relationship of the vasomotor center to shock seems still to be theoretical."

There also seems to be a difference of opinion among other contributors.

It is because of this difference of opinion that we can feel quite sure that the problem of the etiological factors of shock are by no means solved, and for this reason trained experimental surgeons such as Dr. Mann are urgently needed and should be welcomed and aided and stimulated by wholesome and honest criticism.

The clinical surgeon whose day's work brings him into intimate contact with the problems of operative mortality and post-operative complications should endeavor to bring before the experimental surgeon his practical needs. Today, in surgery, shock and infection are the most practical problems. The clinical surgeon needs help in both.

In the past, many men have been of the opinion that research work in the various departments of universities has for its object simply the search for the unknown, irrespective of the needs of the community in which the university is situated. In recent years the universities which have apparently made the greatest progress have been those whose research laboratories have worked upon, and solved, problems helpful to the immediate needs of the people; for example, the University of Wisconsin, with its Department of Agriculture, has brought forth the great development of scientific farming in the Northwest.

The laboratories of physiology in many of our universities have not as a rule been interested in solving the problems of the immediate need of the medical profession. Fortunately, in recent years, in some of the medical schools special departments of experimental surgery and physiology have been organized, often independent of the older departments, and in these new laboratories the workers have been chiefly interested in the investigation of problems of immediate practical importance to the practicing surgeon and physician.

In spite of the fact that physiologists have differed as to the exact etiological factors in shock, their experimental work has been helpful to the surgeon in the recognition, prevention, and treatment of shock.

LEFT-SIDED APPENDICITIS

With the Report of a Case and Classification of the Literature Reports

By JOSEPH H. SCHRUP, M.D., Dubuque, Iowa

AN appendix on the left side, without a transposition of viscera, while unusual, is not an infrequent condition, as the appended bibliography will disclose.

The X-ray pictures here shown were taken of a patient I operated upon some months ago. In two of them the colon was injected with kaolin and shows a distinct angulation at the splenic flexure with the absence of a transverse colon, while the cæcum and ascending colon are in close apposition to the descending colon and sigmoid. The bismuth-filled stomach and intestinal pictures were made to show the stomach in its normal position and the small intestines in the right side of the abdomen. The heart and liver were in their usual position, and the patient was otherwise normal.

The diagnosis was ordinary progressive chronic appendicitis of five years' duration with early ovarian (cystic) and late gall-bladder (cholecystitis) involvement. There was a tenderness at McBurney's point, over the gall-bladder, and in both ovarian regions. The McBurney tenderness seemed as real as in the usual appendix case.

Incision disclosed the double cystic ovaries (each 4 cm. in diameter), but there was no appendix, cæcum, or ascending colon in the usual location. I noticed no omentum at any time during the operation. The jejunum was coiled up in the right half of the abdomen in the customary position of the cæcum and ascending colon. An endeavor to trace up the colon via the sigmoid disclosed the cæcum in that region just behind the sigmoid. The appendix was elongated and congested. There were no adhesions. The mesocolon seemed to have its attachment on the left side of the spinal column, and the cæcum receded to that side when released from the right rectus incision. The usual appendectomy and repair of cystic ovaries resulted in a relief of all symptoms to date. The operation was performed March 19, 1914.

I must leave the reader to judge of the exact anatomical conditions present. I regret the absence of more details, but the prolonged search for the appendix made a closer inspection of the exact anatomical conditions unjustifiable. The skiagrams were post-operative.

To determine the cause and frequency of the conditions found, I employed an expert to make a very thorough search of the literature, and, although I found no report of a case exactly like mine, a few were closely allied. These reports, together with the reports of other anomalous conditions of the colon that have a direct influence upon the position, relationship, and even condition of the oftentimes elusive vermiform appendix, I will take the liberty of reviewing in a general and comprehensive way, as I consider such a knowledge of these conditions to be indispensable in the every-day practice of the average practitioner.

To clarify the subject as much as possible, I will first give an anatomical classification and then an etiological classification. The former I have grouped under six headings, the latter under seven.

ANATOMICAL CLASSIFICATION

Left-sided colons (resembling my case). A case by Cabot (4) was similar to my case, except that the cæcum was loose in the abdomen and there was no definite ascending colon. Two cases by J. Reed (27), one his own, showed all of the colon on the left side, but the cæcum was high and there was coiling of all of the colon proximal to the splenic flexure. He states: "The malposition in both cases was the original formation of the parts and not the effect of the disease or any other agency."

Mr. Berry (3) reported a case as follows: "The cæcum, with the ascending colon and the end of the ileum, was turned upside down and lay in the left side, being kept there by the mesentery."

J. Chiene (6) related a case, found in the dissecting room, "in which the duodenum

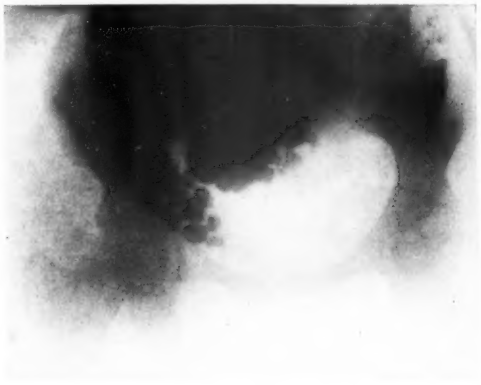

Fig. 1. Kaolin injected colon showing cæcum and rectum to left of midline. (Dr. M. Killeen.)

Fig. 2. Stomach in contraction to left of spinal column; small intestine to right. Colon not injected.

passed upward into the right hypochondrium, and then, sweeping downward into the right lumbar region, became continuous with the jejunum without crossing from right to left in front of the aorta. Nineteen feet of coils of small intestines occupied the right and middle regions of the abdomen. The cæcum was not lodged in the right iliac fossa, but lay loose in the cavity of the abdomen. The mesocæcum, five inches broad, directly continuous with the mesentery, passed to the surface of the last lumbar vertebra. The colon, twisted on itself and not subdivided into an ascending and transverse portion, lay to the left of the middle line, and was continuous with the descending colon and sigmoid flexure, which occupied their proper regions."

As will be noted, all of these cases were in the pre-X-ray period, and so, of course, could have no confirmatory skiagrams as in my case.

Right-sided colons. Two cases of right-sided colons are reported. One is by Esquirol (10), in which the transverse colon, after making a sharp curve in the right hypochondrium, descended perpendicularly in the middle line and entered the pelvis directly behind the pubis. The patient was an insane woman, age 28, who died from obstruction of the bowels. The other was reported by N. Dayabhai (9), wherein he related a case, found at autopsy, in which the descending colon crossed obliquely downward from the splenic flexure to the caput coli in the right iliac fossa. From this point it turned straight across over the promontory of the sacrum to the left iliac fossa. Here it formed the sigmoid, which entered the pelvis normally.

Herniated colons. Cabot (4) reported a congenital hernia of the large intestines into the transverse mesocolon.

E. W. Holmes (16) cites as follows: "R. H. Dawbarn of New York some years ago reported an autopsy in which, through a congenital opening in the left leaflet of the diaphragm, the intestine made its way into the left side of the thorax. The appendix was about two inches long and quite normal. It lay in contact with and partly in front of the pericardium. If this man had ever suffered appendicitis the pain would have been referred to the apex of the heart, or a little to the right of the apex."

T. Thompson (32) saw a male infant, 15 months old, who died after an attack of pneumonia followed by pertussis. "On opening the abdomen only small intestines could be seen. The whole of the colon was found behind the small intestines, and the sigmoid flexure crossed into the right iliac region over the promontory of the sacrum, and there descended into the pelvis on the right side."

Of late (25) there have been some reported

cases of this kind, and there has been some discussion of the subject.

Cæcum in pelvis. J. B. Shober (31) quotes many authors' reports of cases, with their theories. He describes a case of his own of overdevelopment of the cæcal end of the colon. The cæcum was in right pelvis and the sigmoid to the right of the midline (gives drawing). B. Robinson (28), in an article entitled "Unusual Cæca in One Hundred and Thirty Autopsies," says: "The most impressive, unusual cæca are the excessively developed ones which lie on the pelvic floor or are turned toward the middle of the abdomen."

W. Turner (33) reported two cases of malposition of the cæcum with such long mesenteries that they could be displaced to the other side of the abdomen. One was in the right pelvis, the other in the right lumbar region; there was a transverse colon in both cases.

Double intestines. C. B. Lockwood (21), in an article entitled "On Abnormalities of the Cæcum and Colon with Reference to Development," describes two of his own cases and discusses cases of other authors. The description of his own case, wherein he states there was a double colon leading from a subphrenic cæcum, is obscure and doubtful. He says: "The two tubes were upon the same plane, the smaller one nearer the spinal column. Each possessed appendices epiploicæ."

E. Fairland (12) reported the following interesting condition found at autopsy following an unsuccessful left lumbar colotomy: "There was a bifurcation of the intestine, commencing one and one-half inches from the pylorus. One portion, which was probably the small intestine, ended in a blind pouch. The other portion was of a smaller diameter, also ending in a blind sac from which sprang a rudimentary appendix and pipelike portion of gut terminating at the cul-de-sac forming the rectum."

J. M. Alexander (2) also reported a case of double colon in a boy, age 8. This case proves to be not a true double colon, as the title implies, but a reduplication, ascending at the right of the descending colon eleven inches, and descending again to the right and joining the rectum. The whole colon measured six feet.

Complete transposition of the viscera. With a complete transposition of the viscera the appendix would be expected on the left, and the pre-operative diagnosis ought to be made in every case, as the usual general examination would disclose the heart on the right side and at once give the clew. A search of the literature of the last four or five years had disclosed some twenty-six published cases of this sort. Their number in a few years, compared with the number of other kinds of misplaced appendices reported during a period of one hundred years, makes it apparent that the latter condition must be very much more unusual than the former.

ETIOLOGICAL CLASSIFICATION

The explanation of most of the anomalous conditions found are fairly well summarized by the various authors. In a study of their own cases, often combined with the literature reports of others up to the time, and with the aid of embryology, they have come to some definite conclusions, as will be noted by the various appellations.

Non-rotation of colon. C. B. E. J. Nancrede (23), in the report of an operated case and partial review of the literature, ascribes all unusual appendix positions to arrested rotation of the colon. E. M. Corner (8), in an article entitled "Fatal Case of Left-Sided Appendicitis," says: "Clinically, it is frequent to find in children that the cæcum and appendix have not reached the iliac fossa, but have been delayed in their descent or become situated in the umbilical region. It is unusual for the left side of the abdomen or the pelvis to be reached. As a result of these abnormal positions, appendicitis in the young is commonly atypical, and it is necessary to rely on the generality that acute abdominal disease in children is probably appendicitis." V. Rawson (26), in an article entitled "Left-Sided Appendicitis with Death from Preliminary Anæsthesia," says: "The appendix was located to the left of the spine and was removed with great difficulty on account of a very short mesentery and due to

non-rotation of the colon." LePlay (20) describes a subhepatic situation of the appendix in children due to incomplete rotation. A. B. Johnson (17) reports one case due to non-rotation, and writes that Dr. George Brewer said that he had had a similar case. Dr. Joseph A. Blake said he had had two. Howard A. Kelly (19) states: "Abnormal positions of the appendix are caused by an abnormally long mesentery and by arrested fœtal development. A long mesocolon may permit a complete shifting of the large intestines to the left side of the body. The excursions of such a movable ileocæcal apparatus make it possible for the appendix to be located in inguinal, femoral, and umbilical herniæ."

Some classifications of arrested cæcum and appendix positions have been attempted, as follows: (*a*) outside of the abdomen, (*b*) within, close to the umbilicus, (*c*) in left hypochondrium, (*d*) overdevelopment to right pelvis, (*e*) wandering cæcum with long mesentery. One case was reported by Dr. Hilton Fagge (11), in which the cæcum was adherent to the sigmoid and omentum on the left side of the spinal column. J. N. Nicoll (24), under the title "Specimens from a Series of Thirteen Cases in Which the Vermiform Appendix Was Found on Operation in an Abnormal Site," groups the sites under the two general headings, extra-abdominally and intra-abdominally, as follows: (1) extra-abdominally, (*a*) right or left inguinal hernias, (*b*) right femoral hernia, (*c*) umbilical hernia; (2) intra-abdominally, (*a*) under lower margin of liver, (*b*) left iliac fossa, (*c*) right subphrenic region, (*d*) Douglas' pouch.

Retention of fœtal colonic mesentery. Some cases are reported of a persistence of all the original fœtal colonic mesentery. One case by Mr. Chiene (6), and a similar one by Morgagni (24), had only a descending mesocolon.

Mr. Walshaw in *St. Bartholomew's Hospital Reports*, vol. xvi, described a case in which "the descending colon and cæcum remained attached to the right border of the mesentery and had no attachment to the posterior wall of the abdomen." He states that "this is the usual state just before birth."

Elongated appendix. A. Garcia Casariego (5), reporting a prerenal case of Dr. F. D. Roldan's, and both a subhepatic and left iliac appendix for Dr. F. Busquent, asserts that these displacements are not all congenital, but that they may take place in the adult from laxity of ligaments, or an appendix may be so long that its apex is on the left.

Karemski (18) gives excessive length of the appendix as one of the causes of left-sided appendicitis in children.

O. Schellong (29) describes a left iliac abscess case with death. Autopsy showed a long appendix running transversely back of the bladder to the left, with old peritonitic adhesions to the underlying tissues. Child had an appendicitis attack four months before with fever and pain for a few days.

Some years ago I reported a case (30) of an abscess in a girl 11 years old, which filled the left iliac region and extended up the left side as far as the left kidney. The abscess was opened in what was thought to be the center of the loop of the sigmoid to the left of the lower end of the left rectus, as the dullness was most superficial there. There was also a marked tumor and bulging per rectum. The patient eventually recovered. I saw her less then six months ago and she is now a big, healthy girl and says she has had no abdominal trouble since. She had had three distinct appendix (right-sided) attacks in the sixteen months preceding the abscess. Each attack kept her in bed from one to three days. During three weeks preceding the evidence of the abscess there were varying signs and symptoms of the old right-sided appendix trouble. The right side cleared up immediately, however, as soon as the left-sided evidences began.

At that time I thought, and in the light of this paper I still believe, that it must have been an elongated appendix which extended toward the left side and perforated at the tip. A skiagram, however, would be necessary before positively ruling out any other abnormal anatomic intestinal relations, since there never was any intra-abdominal inspection in this case. And, as will be remembered in the case of the cause of this article, there was also only right-sided

McBurney pain and tenderness during the attacks.

Fœtal inflammations. J. B. Shober (31) theorizes: "Fœtal inflammations cause adhesions and arrested development and turning of the colon."

Professor Flower (13) and Cleland (7) state that "a peritonitis occurring in fœtal life by the formation of temporary or permanent adhesions could so modify development as to give rise to almost any deformity, arrest of development, or anomalous position."

Arrested descent of testicle and ovary. According to Serres, Simpson, and G. St. Hilaire (15), "the position of the caput cæcum in the right iliac fossa is intimately connected with the descent of the testicle in the male and that of the ovary in the female." In those cases where the descent of the testicle has been arrested they have found that the cæcum also was arrested. All of these coincident descents are normally complete at the fourth month.

Adhesions. H. Albrecht (1) examined the bodies of five hundred children under six years of age. In 15 per cent he found anomalies of position due to congenital adhesions, and states that even as young as four to eight weeks of age anomalies in position are caused by adhesions.

Other etiological conditions. E. W. Holmes (16) described two post-mortem cases, one incomplete rotation and the other no rotation at all. He says: "Conditions were due to results of intra-uterine inflammations, possibly syphilitic." A. B. Gloninger (14) cited two cases in his experience of subhepatic cæca in children 6 and 18 years of age who had been under very poor dietetic and laboring conditions, which he thought were displaced by the strain of their hard labor, and that the irritation of the cæcum by the poor food then caused them to adhere in this drawn-up position.

CONCLUSIONS

Modern methods of colon injection for diagnosis, and resection for therapeutic purposes, make this field most interesting and ought to disclose more of these anomalous conditions. Most of the literature reports I was able to obtain were made from post-mortem and dissecting-room findings, and some of these are more or less vague and indefinite.

There is no doubt in my mind that in the past many a life has been lost, and in the future many more will be sacrificed, because of the lack of knowledge of the vagaries of this much-diseased organ; either because of a failure in diagnosis, or because the proper diagnosis is not followed by the fortunate discovery, as in my case, of the fundamental source of disability.

DISCUSSION

John B. Murphy, Chicago: "I have gone over your article on 'Left-Sided Appendicitis' and the skiagrams for illustration. It is certainly a good presentation of the subject, and should be of great importance to the profession, as many do not believe that the condition ever occurs, and consequently overlook it entirely, notwithstanding that anatomists have long known that the cæcum does remain on the left side continuous in the line of the original midgut."

E. W. Andrews, Chicago: "The rarity of this anomaly makes the paper a valuable contribution. The reported number of cases in literature are small. I have reported several forms of appendicitis of the right side in former papers. These are:

"1. Transposition of the viscera, which of course alters the relations and brings the organ on the left side.

"2. Excessive mobility of the cæcum, permitting it to become fixed on the opposite side of the abdomen.

"3. The appearance of left-sided tumor from the burrowing upward of a suppurating appendix located in the true pelvis, or from dumb-bell-shaped abscess causing tumor on both sides simultaneously.

"All these conditions are liable to cause mistakes in diagnosis and unexpected developments during operation."

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CONGENITAL INTESTINAL ANOMALIES

By MILTON G. STURGIS, M.D., F.A.C.S., Seattle

CONGENITAL intestinal anomalies are of both anatomic and surgical interest. At first but the curiosities of the post-mortem or the dissecting-room, later recognized at exploratory laparotomy, they are now occasionally distinguished prior to operation. A few years ago the diagnosis of congenital pyloric stenosis excited much comment: such is now made frequently, showing that, though the condition is not more common, it is more readily and surely recognized. The diagnosis of appendicitis in the left iliac fossa, in the epigastrium, or immediately beneath the liver, is made, even though the condition be an infrequent one. Failure of the colon to rotate has been recognized prior to operation, and, with the increased use of X-ray bismuth pictures, both this and other anomalies will be more frequently diagnosed. They are readily divided into three classes: stenosis and atresia; diverticula and cysts; and malpositions.

Stenosis and atresia present a remarkable diversity of forms: diaphragms more or less completely closed; complete membranes; strictures varying from those slight in degree to those which completely obliterate the intestinal lumen. Occasionally the continuity of the intestinal canal may be completely severed, the muscular layers passing smoothly around the blind ends. They occur most frequently in the duodenum — about 35 per cent of all cases recorded; occasionally in the jejunum and upper ileum; frequently in the lower ileum, where stenosis is found in the situation of Meckel's diverticulum, with which it is sometimes associated; and rarely in the colon. In the lower ileum, stenosis is not incompatible with long life, because of the fluid character of the intestinal contents.

In the duodenum, complete occlusion is much more frequent than stenosis — the most common sites being in the vicinity of the biliary papilla and at the duodenojejunal junction. This predominance is important because of the normal development of this particular portion of the intestine. In embryos of 7 mm. it is a tubular structure bordered by epithelium two or three layers thick,

Fig. 1. Drawing of intestines after long immersion in preserving fluid; coils of jejunum cephalad to the obstruction were enormously distended at the time of birth.

which shortly begins to proliferate. Vacuoles are formed which completely block the lumen and divide the duodenum into two, or even three, separate cavities. This continues until the embryo has reached 14.5 mm. and is supposedly due to the resistance of the mesenchyma upon the expanding epithelium, since the diameter of the duodenum increases slowly from 7 to 15 mm. but rapidly thereafter.

Atresia in the jejunum and ileum is quite rare. It does not occur in the process of normal development, as in the duodenum, and opinion is divided as to its cause: whether due to the persistence of developmental defect, or to inflammatory causes — a prenatal peritonitis. In favor of this latter is the fact that meconium, which does not fill the intestines until the fifth month, has been found below a complete occlusion. It would seem, however, that if due to the latter there must be some dilatation below the point of occlusion. When there is no meconium we are warranted in believing the atresia to be due to the first-mentioned cause.

DIVERTICULA AND CYSTS

Diverticula are of two types — false and true. The false are protrusions of mucous membrane through the muscularis. These are found throughout the intestine, and are considered to be acquired usually in later life; yet similar protrusions have been described in embryos, and it is not improbable that these may be sometimes congenital.

Diverticula whose walls correspond in structure to those of the normal intestine belong to the true type. There are but two: a diverticulum having at its apex an accessory pancreas, found in all portions of the intestine; and Meckel's diverticulum which is found in 2 per cent of humans in the lower ileum, on an average of 50 cm. from the ileocæcal valve. Ordinarily a blind pouch 4 to 9 cm. long, on the free border of the gut, it may present a wonderful variety of form: a thimble-like projection, a patulous duct extending to the umbilicus, or a fibrous cord interweaving among the intestines. With both attachments severed, it becomes the most prolific cause of congenital cysts. Its variable origin is made manifest in the sites of these, from one having been reported within 3 cm. of the ileocæcal valve. They may be found within the mesentery, and their contents may be clear, sanguinous, or chylous. Cysts also arise from snared-off portions of the intestines; cases having been reported arising from the duodenum and jejunum by both surgeons and embryologists. Cysts not connected with the development of the intestines, such as dermoids, and cysts from inclusions of portions of the wolffian duct, are occasionally found in the mesentery and posterior peritoneum.

MAL-DEVELOPMENTS AND MAL-POSITIONS

The former, while extremely uncommon, are occasionally found. Cases of the absence of the cæcum, of the cæcum and ascending colon, and of the ileocæcal valve, have been reported.

Perhaps the most striking of the malpositions is the complete transposition of the viscera — over three hundred cases having been reported. That this number will be greatly augumented seems probable, since

a prominent röntgenologist (1) from his own experience reports eight such cases, and but four of failure of the colon to rotate.

The presence of a mesentery in those portions of the colon normally retroperitoneal, may give them a wide range of motion; and an appendix attached to a cæcum which has followed the usual course of development may be found to the left of the midline. Ordinarily, however, mal-positions result from the failure of the intestines to follow fully the usual course of their development, with the arrest of some portion at some point short of the normal one.

In embryos of 4.9 mm. the intestine, a midline vertical tube connected to the spine by a fold of the peritoneum, bends vertically forward toward the junction with the vitelline duct. This slight bend increases and becomes the primary intestinal loop. In embryos of 7.5 mm. the vitelline duct has become detached and is separated from it by a considerable interval. At this time there is noticed an abrupt enlargement of the tube, the *processus vermiformis*, which marks the boundary between the small and large intestine. It is wholly a ventral bulge, first appearing in embryos of 6.25 or 7 mm., and from it develop the cæcum and appendix. In embryos of 9.4 mm. the vitelline duct has disappeared, and the intestinal loop has rotated. The rotation develops as follows:

At first the primary intestinal loop is in the median plane. This loop begins to rotate until its plane is transverse, the superior half lying on the right side, the inferior (the large intestine) lying on the left. This progresses until the large intestine crosses the small intestine, the inferior half of the loop becoming the superior. At 10 mm., because of the rapidly augmenting liver-mass, the intestines begin to pass into the cœlum in the cord — this movement is complete at 22.8 mm. — where they remain until the embryo is about 30 mm., when the return movement begins. This latter is complete at 40 mm. The small intestines return to the abdomen in the sequence of the 6 primary coils, the upper part passing to the left hypochondriac region, the lower part with the cæcum toward the right hypochondriac region,

Fig. 2. Case 2.

the portion of the large gut that lay within the cord now being obliquely placed across the abdomen in front of the duodenum. The cæcum now lies beneath the liver on the right side, which position it retains until shortly after birth, when about the fourth month the sigmoid having become shorter the cæcum is pushed down toward the right iliac fossa, with corresponding lengthening of the ascending colon.

Case 1. This baby was born after severe labor, necessitating forceps. After the head was born, the body was extricated only by strong traction on the shoulders combined with counter-pressure on the fundus. The cause of the dystocia was found to be a greatly swollen belly. When being resuscitated it was noted that bile-stained fluid flowed freely from the mouth. There was a plug of inspissated mucus protruding from the rectum. No meconium was passed in the first 24 hours. An examination gave the following findings: A full-term baby, fairly well-nourished, apparently normal excepting only a greatly distended, tense abdomen. Percussion over this, showed flatness, excepting over the epigastrium and at irregular intervals elsewhere. The white plug of inspissated mucus was still protruding from the rectum. A definite diagnosis of this unusual picture was not to be arrived at, although it was possible to rule out the

Fig. 3. Case 2.

Fig. 4. Case 2.

kidneys and atresia of the rectum as possible causes; so, on consultation, operation was decided upon.

On opening the abdomen there was a gush of meconial stained fluid from the peritoneal cavity. The lower coils of jejunum, enormously enlarged, were found to be ruptured in several places. In lifting them the atresia was found, there being a complete severance of the lumen, the muscularis passing smoothly around the two ends. The serous covering in the form of a small fibrous cord connected them. Below, the ileum and colon were contracted on a core of inspissated mucus, their caliber being about equal to that of a lead pencil. It was not possible to anastomose at any point, and the lesion occurred so high in the small intestine that a fistulous opening had no possibilities. The abdomen was closed with drainage and the baby died some hours after. The post-mortem showed no evidence of meconium below the atresia.

Cases of this sort are ordinarily brought only to the attention of the anatomist or the embryologist; but that they are sometimes brought to the surgeon is evidenced by the report of a case, similar in character, by Edwin Beer (2). The cases brought to the surgeon are those of complete atresia of the intestine, or stricture in the large intestine small enough to interfere with the passage of fæces. The cases having atresia rarely present an opportunity for surgical benefit; since, because of the peritoneal irritation which may be either primary or secondary, there may be numerous bands of adhesions altering the normal anatomical relations, rendering difficult surgical procedure. If the atresia occur anywhere in the intestinal canal other than low in the colon, surgical benefit is impossible, because the contracted caliber of the intestine below the lesion renders anastomosis impossible. Accordingly, the establishment of an artificial anus at such a point as not to interfere with the absorption of nourishment for the child is practically the only procedure. A stricture, however, as noted before, is not incompatible with long life when situated in the small intestine, and when situated in the colon usually does not give symptoms until the infant has gained considerably in resisting power, and these cases offer a fairly hopeful condition for the operator.

Figure 1 shows a drawing of the intestines after a long immersion in preserving fluid. The coils of jejunum cephalad to the obstruc-

tion were enormously distended at the time of birth.

CASE 2. Female 22 years. History of recurring gall-stone colic. History otherwise unimportant, excepting chronic constipation. Operation disclosed pear-shaped gall-stone with its stem in the cystic duct. Gall-stone was removed. It was noted that there was no apparent transverse colon; that the foramen of Winslow was normally placed; that the duodenum covered with peritoneum could be seen directly under the omentum, and that the small intestine was on the right side. The omentum, a very thin lacelike structure, passed from the anterior surface of the stomach down over the small intestines. It was attached to the posterior wall along the right side and was apparently reflected forward over the anterior abdominal wall. There seemed to be a continuity of structure, digital examination showing no evidence of adhesion. The lower coils of small intestine were beyond the lower border of omentum, and lay free in the pelvis. The incision was extended and search was made for the transverse colon, which was discovered to the left of the umbilicus, and about 1.5 inches below. The cæcum, which was very large, was completely covered with peritoneum, and, without a mesentery, lay free in the pelvis. The ileocæcal valve and the appendix were normally placed on the left side. The cæcum was readily pulled up into the wound. The appendix, which was short, thickened, and inflamed, was removed. It had a short mesentery. The ascending colon became retroperitoneal just to the left of the promontory of the sacrum, being very firmly fixed in this position, and emerging from the posterior peritoneum ascended to within 1.5 inches of the umbilicus, where it turned sharply and became what was thought at the time to be the descending colon, shown best in Fig. 4. The bismuth picture shows, in Fig. 3, that it again ascended to the splenic flexure, which was normally placed — a fact which was not ascertained at the time of operation. This abnormality, then, apparently has existed before the embryo was 7.5 mm. long, without any appreciable symptoms other than chronic constipation — a complaint not unusual in the females.

The cases of non-rotation thus far reported have presumably never shown an omentum over the small intestines; there is no mention of such. Conversely, stress is laid on the fact that such a covering is absent; this being one of the marked diagnostic points. Its presence in this case raises an interesting question. Were the small intestines in an extension of the lesser peritoneal cavity which communicates with the larger through the foramen of Winslow as well as the extensive opening into the pelvis? This was the conclusion we reached:

The lower edge of the omentum was fairly taut, and extended from the posterior surface of the right iliac fossa to the right side of the promontory of the sacrum; the anterior layer, passing over the colon, was attached to the left brim of the pelvis. To the left, the anterior peritoneal covering passed from the stomach down the transverse colon, from the colon to the brim of the pelvis. It had the appearance of the normal four-layer omentum. There was no further examination; the abdominal wound was closed and the patient returned to her room. Her convalescence was entirely normal.

Cases of non-rotation of the colon have been reported by Charles Mayo (3), Beekman Delatour (4), and William A. Downes (5). With regard to their occurrence and the occurrence of other intestinal anomalies, Charles Mayo sums up the situation very ably as follows: "The relative rarity of these obscure intra-abdominal abnormalities and the fact that they so infrequently give rise to definite symptoms explain in part why a diagnosis is so seldom made when trouble occurs. However, within recent years the increase in the number of explorations for obscure abdominal conditions, and the enormous increase in operations performed on the intestine for a definite purpose, make it imperative that the surgeon should become familiar with anomalies of the abdominal contents, having in mind the possible conditions."

I wish to extend my thanks to Dr. William F. Whitney, of Boston, for his dissection in Case 1, to Mr. Aitkin for his excellent drawing of the same, and to Dr. Howard Snively, of Seattle, for his excellent X-rays of Case 2.

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FIBRIN AS A HÆMOSTATIC IN CEREBRAL SURGERY

By ERNEST G. GREY, M.D., Boston
Assistant Resident Surgeon, Peter Bent Brigham Hospital
From the Laboratory of Surgical Research, Harvard Medical School, and the Surgical Clinic of the Peter Bent Brigham Hospital, Boston

THE purpose of this paper is to suggest the use of fibrin for controlling hæmorrhage in certain types of intracranial surgery. Fibrin possesses all of the hæmostatic qualities of cotton wet with salt solution and has the advantage that it is absorbed with comparatively slight reaction on the part of the surrounding tissues. Fibrin is easily procured, it is inexpensive, and it may be kept sterile with the other operating room supplies.

During the extirpation of cerebral tumors there is occasionally more or less difficulty in controlling hæmorrhage. Troublesome bleeding is particularly liable to occur with new-growths which have deep, vascular pedicles or which have attachments to the walls of inacessible dural sinuses. In an emergency of this sort the cavity is usually packed with some foreign substance, such as cotton, and moderate pressure made over the wound. When bleeding is started afresh by the removal of the cotton it is the custom of some operators to insert small pieces of muscle or fascia against the bleeding points and hold them in place until the oozing ceases. Cushing (2) and Horsley (5) have found fragments of raw muscle very helpful for this purpose and have noted no ill results to follow their use.

Various kinds of tissues are now recommended for hæmostasis. Hilse (4), Stuckey (8), Chessin (1), Philipowicz (7), and many others have reported successful autoplastic hæmostasis in hæmorrhage from the abdominal viscera with slices of subcutaneous fat, pieces of omentum, and strips of fascia. Philipowicz asserts that this autoplastic method has never failed to arrest hæmorrhage either in the clinic or in experiments, when properly done. In abdominal work Ohkohchi (6) found disturbing adhesions to develop most frequently with slices of muscle. On the other hand, proliferation of connective tissue was most pronounced with pedunculated omental flaps. All of the advantages of these tissues, he believes, can be secured, with none of their disadvantages, by using a slice of sea sponge. It arrests the bleeding mechanically; it is gradually absorbed; and it does not seem to irritate the surrounding tissues—minimal adhesions form later and the parenchyma of the organ does not degenerate. In intracranial surgery Wendel (9) has shown that comparatively large pieces of fascia and subcutaneous fat may safely be transplanted into cerebral defects.

While the methods which employ cotton, muscle, or fascia are usually successful in securing hæmostasis they possess certain obvious disadvantages. In the first place it is often difficult to procure a sufficient amount of fascia or muscle. Though other portions of the patient's body—the thigh for example—may afford an abundant supply of either tissue, the preparation of the leg and the excision of the muscle necessitate a certain delay. This procedure, furthermore, always contributes a slight additional chance for infection. In the second place, it occasionally happens that an inaccessible bleeding area can be controlled only by using a bulky packing material such as cotton. In the subsequent removal of this tampon it is often difficult to withdraw all of the cotton without stirring up fresh hæmorrhage. No operator, however, cares to leave an unabsorbable substance of this nature in the wound, in spite of the fact that animal experiments have shown a good tolerance of the cerebral tissues for cotton.

At the suggestion of Dr. Cushing the writer attempted to find an absorbable material which might be used for this purpose in place of cotton or muscle. The fibrin from sheep's blood ultimately proved to answer most of the requirements. Sheep's fibrin was used because it was readily procured from the Wassermann laboratory.

Serologists usually shake the freshly drawn

blood in a flask containing glass beads until the fibrin formation has been completed. The fibrin collects about the beads in a stringy, spongy mass. In this form it was received for the experiments outlined in this report.

After washing the fibrin repeatedly it is allowed to stand in distilled or tap water for twenty-four hours or longer—until all of the enmeshed red blood-cells have been laked. This brings out the natural white color of the substance and prevents it from assuming a muddy appearance during the subsequent sterilization. After placing the fibrin (previously divided into smaller pieces) into a roomy glass jar containing normal salt solution, the mouth of the latter is covered with cotton and gauze and sterilized. The sterilization softens the fibrin and thus facilitates its absorption by the tissues. It is now ready for use. In this form the fibrin will keep for months.

Two sets of experiments were conducted on animals—dogs and cats. In the first the hæmostatic qualities of fibrin were investigated by using it in a variety of wounds, some with torn vessels and others with lacerations of the sinus walls. When dipped into a physiological salt solution and pressed against bleeding points with a sponge or a wisp of dry cotton, fibrin was found to control the hæmorrhage even better than wet cotton. The soft and pliable nature of this substance made it adhere to rough and smooth surfaces alike. While fibrin probably exerts no appreciable chemical influence on the process of coagulation it appears to possess some mechanical property favorable to the formation of a firm clot. The difference between fibrin and cotton in this respect was clearly shown when pledgets of each material were pressed over bleeding spots and then removed again after a lapse of a minute or two. Fibrin was found to adhere to the underlying structures much more firmly than cotton. This fact probably accounts for the more efficient hæmostasis noted with the former when larger vessels were dealt with.

Clotting may perhaps be hastened by dipping the pieces of fibrin into a solution such as the Kocher-Fonio coagulin (3).

More or less difficulty is frequently encountered in keeping a deeply placed fragment of fibrin in its proper position. In removing the gauze or cotton used to make pressure over the implant the former is apt to loosen or tear the pledget from its bed. A simple expedient found to meet this complication consisted of a ball or finger-shaped piece of dry cotton about which was wrapped a sheet of rubber protective tissue. The edges of the latter were secured at its base with thread. A pledget of fibrin was mounted on the smooth end by firmly squeezing a piece wet with salt solution against the protective. This form of applicator permitted ample pressure to be made on the implant without adhering to it or to the surrounding structures.

In the second series of experiments small pieces of fibrin were imbedded in the cerebral hemispheres of cats. After varying periods the animals were sacrificed and the implants with the surrounding cerebral tissues were examined histologically. The absorption of small blocks of muscle (autotransplants) was followed in a similar way.

About two weeks subsequent to the implantations, sections showed the results of the reaction usual for foreign bodies in general. Great numbers of leucocytes together with numerous new connective-tissue cells surrounded the alien material. Here and there slender new blood-vessels were seen penetrating into the mass. Occasional giant cells appeared near by.

When the animals were allowed to live four to five weeks the process of absorption was found much advanced. Of blocks of muscle tissue which originally measured nine to ten millimeters in all diameters only a few scattered fragments were visible. Implants of fibrin of a similar size appeared at the expiration of this time as a loose granulation tissue enclosing many leucocytes and a few areas suggesting hyaline degeneration. After the sixth week neither substance could be identified.

The reaction of the cerebral tissue was more marked to the muscle implants than it was to the pieces of fibrin. There were greater numbers of leucocytes present with the former and the exudate and granulation tissue extended farther into the enveloping

brain substance. This was most clearly seen while remnants of the foreign bodies were still perceptible. At a later period, six to seven weeks for pieces of the aforementioned proportions, only a small amount of scar tissue marked the sites of implantation of both materials.

The tolerance of the tissues for larger blocks of fibrin proved to be equally good. A piece which measured approximately three and one-half by two by one and one-half centimeters produced no untoward clinical effects and the same type of healing and absorption was discovered when the animal was subsequently sacrificed.

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ESSENTIAL UTERINE HÆMORRHAGE[1]

By S. H. GEIST, M.D., New York
From the Pathological Laboratory of The Mount Sinai Hospital

THE importance to the economy of the ductless glands is now an accepted fact, and consequently many hypotheses have been developed to explain the relations of these glands to various important functions, which were previously either wrongly interpreted, or not at all explained.

Experimentally it has been demonstrated that the generative glands possess an internal secretion. Hegar (1) and Kehrer (2) have shown that castration in female animals resulted in atrophy of both internal and external genitals. Halban (3) transplanted ovaries under the skin of castrated animals, and in those instances in which the transplants took found that the atrophy was prevented. These experiments clearly proved that the ovaries possess a function that exerts a protective influence over the condition of the genitals and acts independently of the nervous system; in other words, a function chemical, or otherwise, acting through the blood stream. Knauer (4) also demonstrated the same fact, and Ribbert (5) and others proved that only a portion of the gland is necessary to maintain the normal condition of the genitals. These experiments demonstrated the existence of an ovarian internal secretion, but just which particular histological structure or structures elaborated this secretion or secretions, if there be more than one, has not been definitely determined. The graafian follicle, the corpus luteum, and the so-called interstitial gland have all been suggested as the possible source.

Bischoff (6) in 1844 first suggested that the periodic maturation of the ovum and the subsequent rupture of the follicle caused menstruation. Recently this theory has been discredited and to the corpus luteum the important rôle has been assigned. Halban, to demonstrate the dependence of menstruation upon the presence of the ovary, transplanted the generative glands under the skin of castrated baboons who continued to menstruate so long as the transplants remained; when they were removed, however, menstruation ceased. Menstruation, in other words, was dependent on the ovary but independent of the nervous system. What part of the ovary is the active one in this regard is still uncertain.

The graafian follicles are present at birth, undergo periodic growth and rupture, and persist even after the climacteric. These structures possess, in addition to their generative function, most probably other important secretory functions, and many writers are inclined to attribute some internal secretory

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influence to the liquor folliculi. Just what rôle the graafian follicle plays in the actual production of menstruation cannot be determined, but in the light of recent investigations it would seem that it had little, if any, part in the direct causation, and that in all probability the corpus luteum is the important factor.

The corpus luteum comes into existence with the onset of puberty and menstruation, and persists, undergoing a cyclical change, until the advent of the menopause. Ruge (7) and R. Meyer (8) have recently shown that the corpus luteum passes through a rapid evolution, beginning with the rupture of the mature follicle about fourteen days before menstruation. The new gland formed from the changed granulosa epithelium has four histologically differentiated phases. These phases have a parallel in the cyclical changes that take place in the uterine mucosa as first described by Hitschman and Adler (9).

The first, or proliferation stage of the corpus luteum, corresponds in time to the interval phase of the mucosa. There is a dilatation of the vessels of the theca, with hæmorrhage and œdema between the cells. The theca cells increase in size while the granulosa cells become cylindrical and transformed into lutein cells.

The second, or vascularization stage, corresponds to the early premenstrual stage of the mucosa. Histologically, there is hæmorrhage from the dilated theca vessels between the granulosa cells and even into the lumen. There is an ingrowth of endothelium from the vessels of the theca forming new vessels between the lutein cells. These cells become larger and contain neutral fat. There is also a proliferation of connective tissue between the lutein cells. The lumen of the corpus luteum becomes vascularized and capillaries and fine connective-tissue cells cover the inner aspect of the lutein-cell mass.

The third stage, which is the full growth (Bluete), represents the completion of the vascularization and corresponds to the late premenstrual stage of the mucosa. Here the lutein-cell layer becomes definitely separated from the lumen by a capillary and connective-tissue layer. The lutein cells grow larger, become polygonal, and show an increased fat content. The lutein layer takes on a wavy, undulating outline.

The final, or regressive stage, corresponds to the menstrual and post-menstrual phase of the mucosa. This stage in the corpus luteum is characterized by a shrinkage of the lutein cells and an increase in the connective tissue between the cells. The blood-clot in the center becomes organized, the theca, which has grown gradually less marked, disappears.

Ruge and Meyer conclude that histologically the corpus luteum seems to be a gland of internal secretion whose greatest secretory activity takes place just before menstruation. Its activity is believed (Ruge) to cause the premenstrual change, and menstruation itself is supposed to be dependent upon it (Meyer).

Fraenkel (10) also classifies the corpus luteum as a gland of internal secretion and believes that it regulates the metabolism of the uterus. It causes the necessary changes in the mucosa for the reception and nidation of the ovum. If fertilization does not take place, the result of the change in the mucosa is menstruation.

Biedl (11), however, does not accept this theory and argues that menstruation may occur without ovulation and consequently independent of the corpus luteum (?).

It would seem, however, that the corpus luteum is concerned in the process of menstruation, for the inception of the menstrual function coincides chronologically with the appearance of the corpus luteum and the subsidence of this function coincides with the disappearance of the corpus luteum.

The third structure, the so-called interstitial gland, in the human species is a rather inconstant find. It has been described as composed of epithelioid cells which are arranged differently in the various species. Limon (12) demonstrated that it arises from the theca interna cells of atretic follicles. Fraenkel (10) believed that in the adult human species there are no such structures. Frank (13) in a careful study of many cases has only once found a structure which he believes can be interpreted as an interstitial gland. The writer has carefully studied the

ovaries removed in many diseased conditions and also normal post-mortem specimens, using special fat stains (sudan III, Sharlach R. and Nilblau), and has not been able to find any definite structures which correspond to the description of the interstitial gland in the human species or that resemble the structures so readily found in rabbits and guinea pigs. Wallart (14) and Seitz (15), on the other hand, have found structures in human ovaries which they believe to correspond to the interstitial gland, so well developed in other species. These they find most marked at puberty, before menstruation, and during pregnancy; at the climacteric they cease to develop. These "glands" are supposed to have a secretory function, this hypothesis being based on the similarity in appearance between them and the cells of the adrenal cortex and also on the presence of fat granules and other cell inclusions, which are looked upon as evidence of secretory activity. Biedl (11) believes that the interstitial gland exercises a local influence on the physiological processes in the female generative organs, and especially upon menstruation. It would seem, however, that the interstitial gland cannot be assigned an important part in the production of menstruation. If the results of Wallart's investigations are accepted, we find these structures present in infancy and childhood, when no menstruation takes place, and also in pregnancy and in pathological conditions associated with pregnancy, as in hydatid mole and chorio-epithelioma.

An analysis of the various facts presented shows that the ovary is essential for the production of the changes in the uterus which result in the phenomenon of menstruation. The structures of the ovary that in all probability are the direct cause of this phenomenon are either the follicle or the corpus luteum, or both.

From the accepted fact that menstruation is dependent on the presence of the ovary and its secretion there naturally arose the supposition that irregular uterine bleeding was also dependent on the ovarian secretory activity.

Previously two great divisions in the types of pathological uterine hæmorrhage were made: (1) those due to systemic conditions, as cardiac disease, anæmias, hæmorrhagic diatheses, diseases of liver and kidney; and (2) those due to local causes. The first group does not concern us in this communication. The second type has been further classified into (a) hæmorrhage due to demonstrable gross lesions, as tumors or inflammatory diseases of the uterus and adnexa, displacements, foreign bodies, and (b) those due to some histological changes in the uterine wall, vessels, or both. It is especially with this latter type that we will deal in this paper. This type of uterine hæmorrhage has a predilection for the two extremes of the sexual cycle; its inception, puberty, and its decline, the menopause. For a long time this condition was considered and treated as inflammatory. It was looked upon as a chronic metritis, whose most important symptom was hæmorrhage.

Scanzoni (16) in his monograph described a condition of chronic metritis which he divided into two stages: (1) that of infiltration characterized by a serous exudation into the tissues and marked hyperæmia; (2) that of induration, in which a relative anæmia of the uterine wall with dryness and increased hardness of the tissues, narrowing of the arterial and venous blood-vessels, and overproduction of connective tissue is found. He, however, made no microscopical examination. This condition was characterized by profuse hæmorrhage, the cause of which was believed to be congestive. The etiology of the chronic metritis was thought to be some circulatory disturbance due to menstrual anomalies, venereal excesses, masturbation, inflammation of the ovaries, or chronic diseases, as heart trouble, pulmonary disease, or anæmia.

Fritsch (17), after a careful study of operative material, most of which was obtained from tumor cases, however, concluded that a productive inflammation, with increase in the connective tissue and a marked passive hyperæmia, was the cause of the hæmorrhage. Most authors agreed that there was an increase of connective tissue in the wall of the uterus. Many looked on this as the result of a previous inflammation, and others as

the result of puerperal subinvolution and displacements. Again, some thought the primary lesion was a disease of the vessels which resulted in poor nutrition in the wall, with consequent fibrous replacement of the muscle and hyperæmia. The endometrium was also looked upon as the diseased area.

Olshausen (18) ascribed the hæmorrhage to a chronic infection of the uterine mucosa, to which he gave the name *Endometritis fungosa*, and which was characterized by marked thickening of the endometrium with preservation of the normal elements, though some of the glands showed dilatation. Ruge (19) agreed with Olshausen's views.

The first one to point out the probable influence of the ovary was Brennecke (20), who advanced the theory that the so-called *Endometritis fungosa* of Olshausen was but the result of a chronic hyperæmia due to reflex nervous impulse from an ovary that is physiologically or pathologically changed, and therefore functionates abnormally.

Reinicke (21), on the other hand, attributes the hæmorrhage to disease of the blood-vessels with coincident intramural connective-tissue overgrowth. Cholmogeroff (22) found conditions similar to those described by Reinicke. The vessels showed a thickening of the media and adventitia with marked narrowing, almost obliteration, of the lumen. The vessels were devoid of the power of contractility.

Theilhaber (23) and his pupils Meier (24) and von Lorentz (25) in a series of articles take an entirely different viewpoint from that of previous writers. They believe, not that the mucous membrane and vessel changes are primary and that the increase in the size of the muscular wall and the connective-tissue overgrowth are secondary, but that the contractility of the uterus is impaired by the interstitial tissue increase, and there results from this a venous congestion which causes the menorrhagia. In these papers the histopathology of the uterus was carefully described. The normal variations in the relative amounts of muscle and connective tissue and their relation to age and pregnancies were discussed. Theilhaber was the first to introduce the idea of lessened contractility as a cause of the hæmorrhage. He emphasized the fact that the increased connective-tissue growth in the uterine wall or the weakening of the muscle might cause lessened contractility. He also described the thickening of the media and adventitia, but believed them to be physiological regressive changes after pregnancy. The change in the endometrium he considered of very slight importance. More recently he advanced the view that some abnormal function of the ovary influences the circulation in the uterus, and because of the defective muscular contractility, either from congenital or acquired weakness of the muscularis, or from fibrous overgrowth, hæmorrhages results.

Pankow (26) in an exhaustive contribution shows that the changes both in the uterine wall and vessels could occur in women who had no abnormal bleeding, and that these changes were the result of regressive processes following pregnancy or menstruation. The ovaries in the bleeding cases present in many instances cystic changes, but nothing that could definitely be associated with the hæmorrhage. Similar ovarian changes were found in women who did not have pathological bleeding. He believed that some disturbed function of the ovary was the cause, but that histologically it could not be determined.

My own investigations were based on the study of twenty-five uteri, in eighteen instances with the adnexa, from patients on whom the diagnosis of "fibrosis uteri" had been made. The clinical pictures in these cases were strikingly uniform. The patients were all about the menopause period, the ages ranging between forty-one and fifty-two years, there being but two younger; one thirty-one, the other thirty-five years of age. The chief complaint was that there had been marked menorrhagia varying from eight to twelve days, in some cases since the first period, and that this symptom in the past year or so had become worse. Some of the women had occasional periods of metrorrhagia. Three of the patients had come into the hospital because of very profuse metrorrhagia dating back two or three weeks. All of the women but one were married, and all but this one had had several children.

The treatment in these cases had been conservative. They had received medical treatment of the usual kind, ergot, styptics, and general tonics, and some had had minor surgical operations, as curettage and cauterization of the endometrium without any permanent benefit. Some had shown temporary improvement, but the symptoms gradually recurred. None of the cases had been treated by the röntgen rays.

I also studied the uterus and adnexa of a young girl of fifteen who had had severe menorrhagia since the onset of menstruation, one year before, and who died from an intercurrent surgical condition. The uterus and adnexa were removed twelve hours after death. The other uteri were all operative material. Uteri of women of all ages from fourteen to sixty who had died from conditions other than gynecological, and in whom the menstrual history was normal, were used as controls. These uteri grossly showed no abnormalities nor did the adnexa.

The uteri from the bleeding cases showed variations in size from just below the normal, accepting 7 cm. as the average normal length, to those showing a definite increase. The smallest organ measured 6.5 cm. in length, the largest 11.5 cm. The wall also varied in thickness, in most instances being about 2.5 cm. (the average normal being 1 cm. to 1.5 cm. in thickness); in fact, only one case exceeded this. There were no gross lesions in any of the uteri or adnexa, either of inflammatory or neoplastic nature.

The consistence of the uterus in most of the cases was firm, more so than in the controls. Some few cases were slightly boggy, due to a moderate œdema. The larger vessels in most instances stood out prominently above the cut surface.

For histological examination, wedges from various places in the uterine wall and also separate blocks of the endometrium, tubes, and ovaries were taken. The material was fixed in formalin and cut, some in celloidin and others in paraffin. The sections were stained with hæmatoxylin and eosin, Weigert elastica, Van Giesen polychrome, methylene blue, and some with Mallory's stains. Frozen sections were made of some of the ovaries and stained with special fat stains (sudan III, Sharlach R. and Nilblau).

The various constituents of the uterine wall and adnexa were carefully studied to ascertain if there were any histological lesions constantly found in these uteri from bleeding women that were not found in the normal controls. In the mesometrium the connective tissue, the muscle, the elastic tissue, and the blood-vessels were studied.

It was almost uniformly found that the connective tissue was very prominent and in many instances comprised one-half or more of the uterine wall. It appeared as broad strands between the muscle bundles and as fine fibrils between individual cells or groups of cells. Especially prominent was the disposition about the blood-vessels where the connective tissue was found arranged in swirls and whorls. It was seen that in the enlarged uteri with thickened walls the main bulk of the tissue was the fibrous element. In the sections stained by the Van Giesen method the zona vasculosa stood out as a brilliant red area.

In the uterus from a forty-eight-year-old virgin, which was the smallest organ in the series, there was only a slight increase in the amount of fibrous tissue, while in the uterus from the young girl of fifteen the amount of connective tissue did not seem to be excessive when compared with normal uteri at this age. In the control uteri from multiparæ the arrangement and amount of connective tissue was similar to that found in the bleeding cases.

When we analyze our findings we must conclude that, while in practically all of our cases of bleeding there is a predominance of connective tissue, it cannot be looked upon as an etiological factor, for the same condition exists in the controls. The predominance of fibrous tissue is most marked in women who have borne children, and whether the numerous pregnancies with the consequent nutritional irregularities, slight traumata, and frequent involutions are the cause of the connective-tissue hyperplasia or not, it seems certain that the fibrosis with its secondary circulatory effects is not the main etiological factor to account for the bleeding.

The study of the musculature reveals no abnormalities. The relative amount of muscle depends entirely on the fibrous tissue content of the uterus. In the cases where there is an increase of fibrous tissue one finds a relative diminution in the muscle tissue, though occasionally in some of the larger uteri we find a well-developed muscular wall, and in addition a considerable increase in the fibrous tissue. In no case, however, could a lesion be found referable to the muscular tissue that could be held accountable for the hæmorrhage. In no instance could I determine a condition of myodegeneration as described by Theilhaber, or evidence of inflammatory involvement of the uterine wall as mentioned by other authors.

The elastic-tissue elements in the bleeding cases did not vary very much, either in arrangement or in amount, from that found in the controls. Pick (27) had shown that the elastic tissue was most abundant in the outer and middle muscular zones, the endometrium and muscularis just beneath the mucosa containing none. Pregnancy causes a marked increase in the amount, which condition persists even after the puerperium.

In the eleven multiparous cases there was considerable elastic tissue massed especially about the vessels and appearing as thick bands and large clumps and plaques. There were also numerous fibrils between the muscle bundles and running in the connective-tissue strands. The most marked amount was seen, however, in the zona vasculosa. Here the condition was similar to that described by Pankow (26), where the elastic tissue had fused, did not react to the special stains as well, and was described by him as elastoid. There arises, of course, the question as to whether these elastoid masses have the usual contractility and functionate as well as the fibrillar structures.

In the two virgin uteri there was very little elastic tissue about the vessels and scarcely any between the muscle bundles. When compared with the controls it was seen that the amount of elastic tissue seemed to be in direct proportion to the number of pregnancies that had occurred. Those women who had the greatest number of pregnancies showed the greatest amount both around the vessels and in the myometrium. This condition persisted until the senile uteri were encountered, where there was a gradual replacement of the elastic tissue by fibrous tissue. The consideration of the occurrence, distribution, and type of the elastic tissue would show that it is entirely independent of the bleeding, and that it is dependent on the involution changes which follow pregnancy.

The vessels in the bleeding cases showed in most instances the following changes: The most striking feature was the marked thickening of the entire vessel-wall. The intima seemed not to be involved to any great extent and presented practically a normal appearance. The most advanced change was seen in the media, which contained enormous plaques and lamellæ of elastic tissue, some of which took on the peculiar appearance of the elastoid masses mentioned before. The musculature of the media was atrophic and presented areas of hyaline degeneration. There was also new connective tissue found both in and about the media and occasional areas of calcification were present. The adventitia was slightly thickened and showed an increase of both elastic and fibrous tissue. In the veins a similar condition was present but not so marked.

It was noted that those women who had borne children presented the most marked vascular changes. The women who had had no pregnancies showed less advanced lesions in the vessels and the young girl of fifteen showed normal vessels. The controls showed a condition similar to that found in the bleeding cases, the most marked changes being in those women who had borne children, while normal vessels were encountered in the uteri of children up to the period of puberty. The picture does not resemble the endarteritis of senility, though in some of the hæmorrhagic cases, as in the controls, a begininng athersoclerosis was present.

From a consideration of these findings we must conclude that the diseased vessels are not the cause of the bleeding and in fact do not always accompany it. It seems much more probable that the vessel changes are due to the uterine involution following re-

peated pregnancies or in a slight degree to the many years of menstruation with its oft-repeated miniature involutions.

The study of the endometrium reveals an interesting picture. In practically every case we find a thickened, velvety mucosa, which histologically bears a resemblance to the premenstrual phase in the normal menstrual cycle. The glands are numerous, often tortuous, and many of them cystic; the latter condition seems to me to be rather characteristic for the mucosa of the bleeding cases. The stroma shows swelling and œdema of the cells and also a varying amount of interstitial œdema. In addition there is usually a moderate congestion with fairly marked dilatation of the veins. Occasionally there are round cells seen either singly or in groups, and scattered polynuclears and occasional plasma cells are encountered. This, however, is a normal condition (Geist, 28) and cannot be interpreted as a sign of inflammation. The entire picture suggests a circulatory disturbance and stimulation simulating the premenstrual change. Pankow (26) had described in many of his cases somewhat similar pictures and believed them to be due to the effect of the bleeding.

In the control cases these pictures were not present, and only in those where the menstrual cycle corresponded were the premenstrual changes found. Similar pictures were seen not infrequently in cases of fibromyomata, but these changes will be considered at another time.

An analysis of the above would lead us to believe that in this finding we have at least a definite morphological picture associated with this condition of hæmorrhage. The cystic dilatation of the glands is rather difficult of explanation. It may be explained partly on the ground that the interstitial œdema and close crowding of the glands leads to interference with the proper discharge of the glandular secretion and a consequent retention and cyst formation. The fluid in these cysts has the same staining reaction as that in the glands during the premenstrual phase, and the cells lining the cysts, though somewhat flattened, have the same morphological and tinctorial characters as the epithelium of the glands during a normal premenstrual phase. In other words, the structures are normal glands whose function is mechanically interfered with.

The changed mucosa is not the cause of the bleeding but simply the result, probably of the same etiological factor, for even after a thorough curettage the bleeding often continues unabated, or, if it does cease, it returns before the mucosa can regenerate. Of course, there is a possibility that even a thorough curettage leaves sufficient mucosa intact to continue the hæmorrhage. Because of the striking resemblance between the mucosa of the bleeding cases and that seen in the premenstrual phase it seems natural to suppose that the same stimulus, perhaps slightly perverted or exaggerated in the pathological case, is the cause of the hypertrophy in both the normal premenstrual stage and in the abnormal bleeding condition.

Examination of the ovaries in these bleeding cases offers no solution. Grossly they present very little that is abnormal. They may be large succulent organs, but are often smaller than normal, sclerotic, and present in many instances numerous small cysts.

Histologically, the vessels show a slight sclerosis somewhat similar to that found in the uterus, but not nearly so advanced. This condition is most marked in women who have had several children. It was absent in the two cases in which no pregnancies had existed. The controls show the same condition, and we are led to believe that the vessel changes are due to the preëxisting pregnancies and subsequent involutions.

The glandular structures in the ovaries show no striking changes. The follicles were not increased; in fact, they were in most instances very few in number, which might of course be accounted for by the age of the patient. There was no histological sign of hyperactivity; in fact, many were cystic and showed degeneration of the epithelium and disappearance of the ova. The structures representing the regressive processes, as corpora atretica and corpora albicantia, did not differ from those in the control. The corpora lutea histologically showed no definite cellular abnormality.

In some instances the ovaries were slightly enlarged and œdematous, which was due to a moderate congestion comparable to that seen in ovaries from women in the premenstrual phase of the menstrual cycle. These findings correspond somewhat with the cases described by Kaji (29), which, though not characteristic, are fairly constant. In other words, the ovaries showed no sign of hyperactivity, judging as we can from gross and histological examination. If one considered the follicles, the picture is that of a regressive change.

An analysis of the microscopical findings results in the conclusion that a definite histological lesion cannot be found to account for the profuse bleeding. Two lesions stand out as a constant accompanying factor: one the hyperplastic mucosa with its œdematous stroma and cystic glands, and the second the ovary with its cystic follicles and degeneration of the epithelium and ova.

The condition is surely not due to an inflammatory lesion of the myometrium with fibrous replacement of the destroyed muscle or to an acute or a chronic endometritis, for there are no signs histologically of such conditions. The enlargement of the uterus is due to the marked congestion and stasis, together with the moderate connective-tissue hyperplasia that is often present.

The pathological bleeding comes on in the extremes of sexual activity: the beginning, puberty, and the end, menopause. Coincident with this are the periods of functional change in the ovary, in one the follicular activity, and in the other follicular regression. It would seem justified in assigning an important rôle in this condition to the ovary. Whether the condition in the ovary is entirely the cause or whether it is just one factor cannot at present be stated.

Mosbacher (30) found that in 80 per cent of the functional menorrhagias and metrorrhagias there was a vagotonic disposition, and in a majority of the cases of ovarian hypofunction, as in castrated women and those suffering from amenorrhœa, that a similar vagotonic disposition occurred. He does not, however, wish to conclude that these functional hæmorrhages are due to a pure hypofunction of the ovary and suggests as a possibility a dysfunction as the cause. Adler (31) found an increase in the irritability of the autonomic system in cases of functional hæmorrhage, and in castrated women an increase in the sympathetic tone. He believes that the ovary has a depressor effect on the sympathetic system. From this he reasons that the increase in the irritability of the autonomic system in the cases of functional hæmorrhage is due to an excessive sympathetic depression, or, in other words, to the hyperfunction of the ovary.

Against a pure hypofunction of the ovary weighs the fact that removal of the ovary causes complete cessation of the bleeding, and also that X-ray sterilization leads to amenorrhœa. Against a pure hyperfunction is the fact that the condition arises in those periods when the function of the ovary is just being initiated or when it is on the decline.

The histological picture of the ovarian changes does not indicate a hyperactivity, rather the contrary. At puberty a few ripening follicles, often many cystic ones and others with degenerating epithelium, and in the older women a few normal follicles and numerous cystic and degenerated ones, are seen. To ascertain what part of the ovarian apparatus is at fault is rather difficult. We do know from experimental evidence that the X-ray affects the follicle apparatus and destroys it. We also know that the bleeding due to fibroids or the essential hæmorrhage can be absolutely controlled by raying. This would seem to imply that it is the follicle and its secretion, or some product of the follicle (corpus luteum), that is really at fault. It is a matter of common knowledge that insufficient raying causes an increase in the hæmorrhage and would lead us to suppose that the X-ray in these cases produces an abnormal function of the follicle either by stimulation, when not in sufficient strength to destroy, or by partial degeneration. In short, it would seem that in the ovary it is either the activity of the follicle or its product, the corpus luteum, that is the disturbing factor.

That the effect on the follicle may be in-

fluenced by the secretion of other endocrinous glands or that a disturbed balance between these glands may exist may be deduced from the recent work with organ extracts. Sehrt (32) showed that certain of these causes of essential bleeding can be absolutely controlled by the exhibition of thyroid extract, especially those cases occurring in young women. Fromme (33) has reported good results by the use of pituitary extracts in amenorrhœa, having caused profuse menstruation when previously there had been none. Recently Hofstaetter (34) has had very good results from the hypodermatic administration of pituitrin in the menorrhagias of puberty. Schultze (35) has reported fatal cases of metrorrhagia associated with adenoma of the hypophysis and aplasia of the thyroid. On the whole it would seem that there are variations in the etiology of the essential uterine hæmorrhage, and that in some instances one gland like the ovary, thyroid, or pituitary may be at fault, supplying a secretion that is abnormal and so upsetting the balance of the entire endocrinous system.

Therapy in these cases will of necessity be individual, and only when we have advanced sufficiently to be able to classify the various types can we attempt to influence them by opotherapy.

I wish to thank Dr. F. S. Mandlebaum, director of the laboratory, for the privilege of studying the material, and also to express my appreciation to Dr. J. Brettauer and Dr. F. Krug for their kindness in allowing me the use of the clinical data.

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THE ABDERHALDEN REACTION IN MALIGNANT TUMORS, PREGNANCY, AND ANGIOSCLEROSIS

Report of a Year's Work[1]

By CHARLES GOODMAN, M.D., F.A.C.S., New York
Clinical Professor of Surgery, New York University
AND
SAMUEL BERKOWITZ, M.D., New York
Ehrmann Fellow, Physiological Chemistry, Beth Israel Hospital

WHILE I was in Goettingen working on the problem of the transplantation of organs under Prof. Hermann Stich, we succeeded in transplanting thyroids and spleens in dogs by the aid of blood-vessel suture. Our object was to determine a method of overcoming those biochemical differences in animals which are responsible for autolysis and the eventual absorption of the transplant. At the suggestion of Professor Stich, I went on to Halle to study under Professor Abderhalden his method of detecting protective ferments. Abderhalden proposed that we should begin by transplanting thyroid glands in dogs with a view of determining by dialysis which organs of the body were susceptible to insult following such transplantations.

I had brought to America a complete equipment for the test such as is used at the Halle Laboratory. The technique of the transplantations consisted in restoration of the normal circulation as far as possible by blood-vessel suture. The details of these experiments were published in the *Annals of Surgery*, 1915. In an article published in Surgery, Gynecology and Obstetrics, December, 1914, we reported our first results in the diagnosis of malignancy with the Abderhalden test. A review of the literature of 1914 and the early part of 1915 shows many conflicting reports, and a critical glance at its contents seems advisable in view of the importance of the test for the early diagnosis of malignant tumors.

Boldt reports 43 cases of complicated pregnancy. In 28 the clinical diagnosis of pregnancy was made. The reaction was correct 27 times and incorrect once. In 6 cases the clinical diagnosis was doubtful and the reaction proved correct in 5 and wrong in 1. None of these women were pregnant. In 6 other positively non-pregnant women, the Abderhalden reaction was weakly positive 4 times; in 1 the reaction was made just prior to menstruation. In 2 of the women the reaction was negative; that is, correct. In 3 cases extra-uterine pregnancy was suspected. The diagnosis in 2 of these was negatived by the reaction, which proved correct. The third case was verified as having a tubal gestation in the course of abortion, but the reaction was negative. Boldt concluded that the Abderhalden test was no more than an aid to diagnosis, but in doubtful cases it was a very valuable aid.

Echols carried out the test on 95 women, 70 of whom were known to be pregnant. The pregnant women gave positive reactions. About 12 per cent of non-pregnant individuals gave positive reactions, including several patients just operated on for acute or chronic appendicitis, pus tubes, fibroids, and ovarian cysts. Echols concluded that the dialysis test for pregnancy was of value chiefly in a negative sense; that is, if a woman failed to give a positive reaction, she was not pregnant. If, on the other hand, she gave a positive reaction she was probably pregnant. Echols also criticized the use of parchment tubes or thimbles on the ground that their permeability to peptones and amino-acids became altered by boiling, which is the only method of sterilizing them perfectly.

Schwarz reported 41 cases known to be pregnant which gave positive reactions and 30 cases known to be not pregnant which gave negative reactions. Schwarz is a believer in the strict specificity of cancer and pregnancy ferments. In 5 cases of cancer examined, the cancer sera gave strong reactions with cancer albumin and faint re-

From the Physiological Surgical Research Laboratory, New York University, and the Laboratory of Physiological Chemistry, Beth Israel Hospital.

actions with placental albumin; while the pregnant sera gave strong reactions with placental albumin, and weak reactions with cancer albumin. Schwarz ascribed the faint reactions to poorly prepared albumins.

Wohl concluded from his own 22 cases of pregnancy, in all of which a positive reaction was obtained, and from the review of all the literature up to the first of 1914, that the reaction for pregnancy stood on the same level as Wassermann's for syphilis; i.e., the reaction was positive in 80 to 90 per cent of the cases.

Wohl predicted a great future for the test for further research in pathology and therapeutics and cited 14 cases of epilepsy in which he found that cases which had progressed to the stage of dementia showed a ferment splitting up brain and testicle; serum of 2 of these cases showed cleavage of thyroid tissue as well. Furthermore, 3 patients who had had an attack a few hours before the blood was taken, reacted against brain and testicular tissue. He did not feel justified in drawing conclusions from the few cases he observed, but believes that Abderhalden's reactions will prove of great benefit in throwing more light upon the etiology as well as the prognosis of epilepsy. He also reported 2 cases of cancer in which the positive reaction was confirmed by operations.

Ball had correct reactions in 27 cases of tumors clinically or suspiciously malignant and in 22 non-malignant cases. There were three errors in positive reactions which Ball could not explain. He agreed with Frank and Heimann that certain pathological conditions such as myomata of the uterus, metritis and endometritis occasionally give a positive malignant reaction when not expected. Ball believes that poorly prepared substrata explained practically all of his erroneous findings, that bad thimbles came second, and that until further work perfected the technique, a clean-cut negative reaction carried much more weight than a positive one. Ball added that the association of this test with the bismuth meal and colonic injection made the strongest combination now at our command in the diagnosis of gastro-intestinal diseases.

Levin used adenocarcinoma of the breast tissue and obtained serum from 13 cases of carcinoma, 4 cases of sarcoma, 12 cases of pulmonary tuberculosis, and 8 cases of light nervous ailments. In the 13 carcinoma cases, 12 were positive and 1 negative. The sarcoma cases were all positive. Of the 12 tuberculous cases, 5 were positive and 7 negative, and of the last series, 4 were positive and 4 negative. Levin concluded that, while the test is more frequently positive in carcinoma, it could not be considered actually specific, since the same ferments seem to appear in the serum of non-carcinomatous individuals. He believed that the proteid substance which the ferments split up must be made to be more clearly specific and the test itself must be finer and not dependent on the behavior of the dialyzer. Levin finally remarked that for the present the method belongs to the research laboratory and not to the clinic.

R. St. Leger Brockman reported 25 cases of carcinoma and 20 cases in which carcinoma could be excluded beyond reasonable doubt. The test was positive in all 25 carcinoma cases and negative in the controls. One error in a control case was probably due to incubation lasting only 16 hours. Brockman believed his evidence sufficient to conclude that the test was specific for cancer.

J. Bauer had correct results in 8 carcinoma cases, but in 30 non-carcinomatous cases only half were negative. These cases were stomach patients with gastric ulcer and achylia gastrica. Bauer concluded that the technique of the test was insufficiently developed, but he believed that we are at the beginning of the rich harvest promised by the Abderhalden basic ferment theory.

Oeller and Stephan have constructed a new apparatus for the boiling of the dialysate to facilitate strict asepsis and to enable the worker to boil very rapidly a number of tests, obtaining at the same time an even boiling temperature.

Abderhalden in his Leyden lecture stated that the test was correct in 50 carcinoma cases and that sarcoma and carcinoma could be sharply distinguished. Abderhalden added that about 600 cases of pregnancy correctly

diagnosed by his test proved that only experimental errors lead to erroneous diagnoses.

Bornstein reported that he had positive results in 70 per cent of many of his carcinoma tests but in others only from 40 to 50 per cent. He concluded that if the reaction was positive, carcinoma is certainly present, but if it is negative the patient might nevertheless have a carcinoma. Bornstein thought that when the blood was pressed out of the preparation the greatest part of the cancer foci was also pressed out, and the preparation became too weak.

Mayer reported 18 carcinoma cases which had positive results, and gave his interesting experiments with the test on the ductless glands.

Oeller and Stephan attributed all errors to the dialyzers and their permeability, and required two tests for a positive result and several non-specific organ substrata for the specificity control.

De Waele found that thymol added to the serum and to the thimble wash aids in obtaining correct results.

Plant proved in experiments on 40 psychiatrical cases that an increase of the proteolytic ferments in the dialysate could be caused by the presence of an organic, non-proteolytic substance, and that this factor of absorption must be reckoned with as a possible source of error. This has also been pointed out by Abderhalden on page 190 of the third German edition of *Abwehrfermente*.

Erpicum had 98 per cent correct results in 51 of his observations.

Kämmerer, Clausz, and Dieterich had difficulties in their twelve series of experiments on ductless glands and carcinomata which they ascribe in great part to the inequality of the thimbles.

Singer in five series of experiments and in the verifications of the experiments of Hilner and Petri arrived at the conclusion that the strict specificity of the test has not yet been proved and that the dialysis method was not yet ready for general use.

Guggenheimer believed that the divergence of results of the different authors in respect to the specificity of the ferments in the carcinoma and organ diagnosis might be due to the occasional factor of an associate destructive ferment and also to the ground tissue of the tumor, as occasionally uterus carcinoma might be digested by the serum of non-carcinomatous genitally diseased patients. Guggenheimer also pointed out that an organic injury involved secondary disorders of other organs, the functional disturbances of which are indicated by the presence of the corresponding serum ferments. He concluded, however, that the specificity was far-reaching.

Allmann had success in pregnancy diagnosis but dubious results in 12 carcinoma cases.

Heimann and Fritsch reported 34 reactions in carcinomata which were afterward proved by histological tests. They believed that when the Abderhalden test is perfected in technique and that with the exclusion of undesirable material a carcinoma might even be diagnosed from two to three weeks before its beginning, and thus the carcinoma prognosis might be rendered immeasurably more favorable.

Ball reported 51 cases. Of the 6 cases clinically malignant the reaction was positive. Of the suspiciously malignant conditions examined, 20 of the 28 gave positive reactions, which were verified by röntgenograms in 3 persons, post-operative microscopical section in 10 instances, and definite subsequent histories in 7 cases.

Benech had correct results in 20 cancerous cases and 25 control cases.

Csépai attributed his unsatisfactory results to errors in technique, especially to faulty thimbles, and believed that the test had great value especially in the diagnosis of disorders of internal secretion.

Lampe and Paregger pointed out that the substrata must be prepared, tested, and handled with the greatest care and that the verdict as to the specificity of the ferments depends entirely upon them.

Fritsch believed that the carcinoma test will only be reliable in the hands of experienced investigators working in a large laboratory.

Berghausen had successful reactions in 41 tests, except that the serum of 2 patients suffering from carcinoma of the uterus failed to digest placental tissue and that the serum of 1 pregnant woman failed to digest epitheli-

ABDERHALDEN REACTION IN CANCER

Case Number	Referred By	Ccm. Serum each Test	Time of Dialysis (hrs.)	Serum Control	Serum + Carcinoma	Serum + Sarcoma	Serum + Placenta	Serum + Stomach	Serum + Artery	Serum + Pancreas	Serum + Adrenal	Serum + Large Gut	Clinical Diagnosis	Remarks
D. 10	Dr. M. Fishberg	1.5	18	o	+	o							Recurrent carcinoma breast	Adenocarcinoma.
M. 11	Montefiore Hosp.	1.5	18	o	+	o							Carcinoma intestines	Post-mortem.
M. 12	Montefiore Hosp.	1.0	20	o	+	o							Carcinoma breast	Adenocarcinoma.
M. 13	Montefiore Hosp.	1.0	18	o	o	+++							Retroperitoneal sarcoma	Post-mortem.
B. 14	Dr. L. J. Ladinski	1.5	18	o	+	o	o						General carcinomatosis	Marked cachexia.
B. 15	Dr. C. Goodman	1.5	20	o	+++	o							Tumor, abdomen	Adenocarcinoma, stomach, op.
B. 16	Dr. C. Goodman	1.0	16	o	o	+							Sarcoma, testes	Hydrocele fluid.
B. 17	Dr. A. A. Himowich	1.5	20	o	++	o		o					Carcinoma liver	Refused exploration.
M. 18	Montefiore Hosp.	1.0	24	o	o	++							Sarcoma femur	Section typical.
M. 19	Montefiore Hosp.	1.5	24	o	o	o	+						Carcinoma uterus (?)	+Wassermann.
M. 20	Montefiore Hosp.	1.0	24	o	+	o	o						Carcinoma breast	Operated.
M. 31	Montefiore Hosp.	1.5	24	o	o	++							Retroperitoneal sarcoma	Ascitic fluid; post-mortem
M. 32	Montefiore Hosp.	1.5	16	o	o	+			o				Retroperitoneal sarcoma	Blood serum.
P. 1	Dr. C. Goodman	1.0	24	o	+	o							Post-op.; carcinoma breast	4 years; no recurrence.
P. 2	Dr. C. Goodman	1.5	20	o	+	o							Recurrent carcinoma breast	Adenocarcinoma.
B. 41	Dr. R. Lewisohn	1.0	18	o	+	o							Carcinoma stomach and liver	Operated.
P. 3	Dr. L. Friedman	1.0	20	o	++	o				o			Carcinoma stomach	Operated.
B. 42	Dr. A. A. Himowich	1.0	24	o	+	o							Carcinoma stomach	Refused operation.
M. 33	Montefiore Hosp.	1.5	20	o	+	o					+		Carcinoma recti	Post-mortem.
M. 34	Montefiore Hosp.	1.0	24	o	+	o							Carcinoma liver	Post-mortem.
P. 4	Dr. C. Goodman	1.5	20	o	+	o							Carcinoma stomach	Operated.
B. 43	Dr. L. J. Ladinski	1.5	16	o	+	o							Carcinoma breast	Operated.
B. 44	Dr. D. Robinsohn	1.0	24	o	+	o							Carcinoma liver	Refused operation.
B. 45	Dr. C. Goodman	1.5	24	o	+	o							Carcinoma recti	Refused operation.
B. 50	Dr. C. Goodman	1.0	24	o	o	o							Carcinoma breast	Operated.
M. 35	Montefiore Hosp.	1.0	24	o	+	o							Carcinoma liver	Ascitic fluid; post-mortem.
B. 51	Dr. C. Goodman	1.5	24	o	+	o		+					Carcinoma stomach	Refused operation.
B. 52	Dr. A. A. Himowich	1.5	24	o	++	o			o				Carcinoma stomach	Operation.
B. 53	Dr. C. Goodman	1.5	24	o	++	o		+					Carcinoma stomach	Operation.
B. 54	Dr. A. A. Himowich	1.5	24	o	++	o			o				Carcinoma stomach	Operation.
B. 55	Dr. D. Robinsohn	1.5	24	o	+	o							Carcinoma stomach	Operation.
B. 57	Dr. D. Robinsohn	1.0	24	o	++	o							Carcinoma pancreas	Marked jaundice; refused operation.
P. 5	Dr. L. J. Ladinski	1.0	18	o	+	o	o						Carcinoma recti	Operation.
V. 101	Dr. G. D. Stewart	1.0	24	o	+	o							Carcinoma cervix	Post-operative 7½ years.
V. 102	Dr. G. D. Stewart	1.0	24	o	+	o							Carcinoma stomach	Post-operative.
V. 103	Dr. G. D. Stewart	1.0	24	o	o	o							Tumor, breast	Age 51 years; mass in breast.
B. 104	Dr. G. A. Friedman	1.0	24	o	+	o							Carcinoma stomach	Post-operative.
B. 105	Dr. L. B. Meyer	1.0	24	o	+	o							Carcinoma liver	Post-operative.

ABDERHALDEN REACTION IN CANCER—*Continued*

Case Number	Referred By	Cem. Serum each Test	Time of Dialysis (hrs.)	Serum Control	Serum +Carcinoma	Serum +Sarcoma	Serum +Placenta	Serum +Stomach	Serum +Artery	Serum +Pancreas	Serum +Adrenal	Serum +Large Gut	Clinical Diagnosis	Remarks
V. 106	Dr. G. D. Stewart	1.0	24	o	+++	o							Carcinoma pancreas	Clinically.
V. 107	Dr. G. D. Stewart	1.0	24	o	+	o							Carcinoma breast	Recurrence.
M. 111	Montefiore Hosp.	1.5	16	o	++								Carcinoma recti	Adenocarcinoma.
P. 112	Dr. J. T. Lynch	1.5	24	o	+							+	Carcinoma stomach	Under observation.
M. 113	Montefiore Hosp.	1.5	48	o	o	+++							Multiple myeloma	Bence-Jones Albuminuria.
B. 114	Dr. A. A. Himowich	1.5	48	o		+							Retroperitoneal sarcoma	Clinically.
B. 115	Dr. A. A. Himowich	1.0	24	o	+	o						o	Carcinoma lungs	Post-mortem.
P. 117	Dr. J. T. Lynch	1.5	18	o	+	o							Carcinoma stomach	Same as No. P. 112.
P. 118	Dr. C. Goodman	1.0	24	o	+	o						+	Carcinoma recti	Operated.
U. 120	Dr. G. D. Stewart	1.0	18	o	+	o							Carcinoma large gut	Clinically and X-ray.
P. 121	Dr. J. T. Lynch	1.0	18	o	+	o						+	Carcinoma stomach	Under observation.
B. 122	Dr. H. M. Silver	1.0	18	o	+	o							Carcinoma stomach	Operated.
U. 124	Dr. G. D. Stewart	1.0	17	o	o	o							Epithelioma œsophagus	Substrate: adenocarcinoma.
U. 125	Dr. G. D. Stewart	1.0	17	o	+								Carcinoma cæcum	Operated.
U. 126	Dr. G. D. Stewart	1.0	17	o	+								Carcinoma cæcum	Recurrence.
U. 127	Dr. G. D. Stewart	1.0	17	o	+								Carcinoma pancreas	Operated.
U. 134	Dr. G. D. Stewart	1.5	24	o	+	o						o	Carcinoma lip	Operated.
B. 136	Dr. C. Goodman	1.0	24	o	o	+							Endothelioma larynx	Recurrence
P. 137	Dr. L. Friedman	1.0	24	o	+								Carcinoma uterus	Post-operative.
P. 139	Dr. L. Friedman	1.0	24	o	+	o							Carcinoma cervix	Post-operative
B. 142	Dr. C. Goodman	1.0	24	o	+	o							Carcinoma recti	Post-operative
B. 143	Dr. D. Robinsohn	1.0	24	o	o	+							Sarcoma glands	Typical pathology.
B. 145	Dr. L. J. Ladinski	1.0	24	o	+	o							General carcinomatosis	Clinically
U. 146	Dr. G. D. Stewart	1.5	18	o	+	o							Abdominal tumor	Under observation.
B. 250	Dr. Isadore Seff	1.5	24	o	+	o						++	Carcinoma liver	Operation.
B. 251	Dr. Isadore Seff	1.5	24	o	+++	o							Carcinoma bladder	Inoperable; cystoscopy

oma tissue, while that of another digested it. Oettinger, Fiessinger, and Pierre Marie reported that in their 63 cases the reaction was positive in two-thirds of the cancer cases and negative in one-third. In the noncancerous affections the reaction was positive in one-third of the cases and negative in two-thirds. The authors concluded that the test was only very little, if at all, superior to the other laboratory methods.

Bisgaard and Korsjbjerg did not consider the ninhydrin method delicate enough to ascertain the protease action and reported unsatisfactory results from their experiments.

Fritsch remarked that when a number of parallel tests were made, the possibility of errors from the thimbles was of course decreased, but holds to his original opinion that the test may be used only as an adjunct.

Keitler and Lindner proved that exposure to X-rays has a retarding influence on the formation of ferments in animal experiments.

Schumkowa-Trubina found that the test was positive in about 95 per cent of the cancer cases, and the greater the homology between the substrate and the tumor of the case tested, the more frequent were the successful results.

Otto and Blumenthal had conflicting results and did not think the test was suitable for clinical purposes.

Parodi and Vidoni had conflicting results, and were extremely pessimistic as to the specificity of the test for pregnancy or for malignancy.

Gavronsky believed that the negative results of the test in suspected malignancy spoke strongly against the existence of such conditions.

Biehn reported that the results of his experiments on animals regarding the protective ferments had borne out Abderhalden's statements as to their specific nature. He believed that greater reserve in reporting successful results was necessary and that we demand too much of the test, forgetting that all laboratory findings must be taken only as additional symptoms that serve to confirm or deny the other clinical signs.

Falls agreed in the main with Biehn's opinion of the value of the test as corroborative evidence, but was more pessimistic.

We are inclined to believe that a part of the unsuccessful results obtained by the authors should be ascribed to technical errors. In some of the instances these have been caused by poorly directed efforts to simplify an intricate and delicate technique even before the workers have mastered the test as described by Abderhalden in his book, *Abwehrfermente des tierischen Organismus*, 1913, which has now been translated into English.

In our work during the past twelve months the results have been more uniformly in accord with the research at the Halle Laboratory of Professor Abderhalden. We have made in all 334 dialysis tests, and of this number 27 were discarded because the blood was contaminated or else was withdrawn too soon after eating.

In cancer we have examined the blood of 64 patients. We obtained positive reactions in 58. In all of the 58 cases the positive diagnosis of malignancy was confirmed later by clinical, operative, or post-mortem evidence. Of the remaining 6 cases, 3 are still under observation.

We believe that the Abderhalden dialysis reaction as a corroborative test for malignancy has equal importance with any of the other recognized clinical laboratory methods of serum diagnosis.

We desire to repeat with emphasis that negative results are even more valuable than positive results.[1] To verify our positive findings and avoid discrepancies we invariably used a thimble containing serum alone. A positive reaction with ninhydrin in the control dialysate was attributed to errors in our technique, which arose either from contamination while the specimen was being obtained or in the handling of the thimbles. These were therefore discarded. We did not use blow wash bottles on account of the danger of contamination from saliva, as saliva gives a positive reaction with ninhydrin in parts of 1:1,000,000 (Abderhalden).

Our cases of malignancy consisted of the following: 16 with carcinoma of the stomach; 9 with carcinoma of the breast; 10 with carcinoma of the intestines; 6 with carcinoma of the liver; 4 with carcinoma of the uterus; 3 with carcinoma of the head of the pancreas; 1 with carcinoma of the lungs; 2 with general carcinomatosis; 1 with epithelioma of the lip; 1 with carcinoma of the bladder; 1 with multiple myelomata; 1 with an abdominal tumor; 1 with carcinoma of the œsophagus; 1 with endothelioma of the larynx; 4 with retroperitoneal sarcoma; 1 with sarcoma of the testis; 1 with sarcoma of the femur; and 1 with sarcoma of the cervical glands. Of these cases, No. B. 16, a hydrocele of the tunica vaginalis, was diagnosed as a sarcoma; No. B. 50, a positive case of carcinoma of the breast, and No. U. 124, an epithelioma of the œsophagus, were diagnosed as negative.

In a large series of pregnancy tests, the results were uniformly satisfactory. In order to illustrate the value of the test as a factor in determining the course of procedure where the usual clinical symptoms were not sufficient to form definite conclusions, we add the details of the following cases:

In No. P. 72, a multipara, age 39, her last pregnancy 17 years before, menstruation was regular until last menses six weeks prior to the examination which revealed a pelvic hæmatocele. The Abderhalden reaction was positive with placenta.

In patient No. P. 71, a woman about 20 years old, primipara, pregnant three

[1] Surg., Gynec. & Obst., 1914, xix, 797.

PREGNANCY WITH COMPLICATIONS

Case Number	Ccm. Serum (Each Test)	Time of Dialysis (Hours)	Serum Control	Serum + Placenta	Serum + Thyroid	Serum + Stomach	Serum + Pancreas	Stage of Pregnancy	Remarks
P. 71	1.0	20	0	+	+		0	Third month	With glycosuria
P. 72	1.0	20	0	+++					
D. 73	1.5	18	0	+		0		Ten weeks	
D. 74	1.5	24	0	++		+		Fifth month	Nausea and vomiting.
P. 75	1.0	24	0	++					With pulmonary tuberculosis

ANGIOSCLEROSIS

Case Number	Ccm. Serum (Each Test)	Time of Dialysis (Hours)	Serum Control	Serum + Artery	Serum + Brain	Serum + Adrenal	Clinical Diagnosis	Remarks
B. 260	1.0	24	0	0	0		Tertiary lues; cerebral complications	
M. 261	1.0	24	0	+	0		Paralysis agitans; arteriosclerosis	Blood pressure, 190.
M. 262	1.0	20	0	++	0		Arteriosclerosis	Age 74.
B. 263	1.5	24	0	+++		0	Angiosclerosis	One year after arteriovenous anastomosis. Placenta and serum also negative.
B. 264	1.5	18	0	+++		+++	Angiosclerosis	Post-operative
B. 265	1.0	18	0	+	0	++	Angiosclerosis	Post-operative
M. 266	1.5	24	0	++			Arteriosclerosis	Hemiplegia
P. 267	1.5	24	0	++		++	Angiosclerosis	Post-operative.

months, the urine showed marked traces of glucose. An Abderhalden test gave a positive reaction with placenta and thyroid and a negative one with pancreas. Glycosuria disappeared at the termination of pregnancy.

Patient No. P. 73, an interesting case at the Presbyterian Hospital, was a young woman on whom left nephrectomy for renal tuberculosis had been performed by Dr. Blake at the Presbyterian Hospital prior to her marriage. After 18 months, the surgeons were of the opinion that she might safely marry, provided she had no children. A guinea pig injected with a catheterized specimen of her urine remained well for two months and at autopsy showed no tubercular lesions. Ten months after marriage, she went to see Dr. Whipple in regard to her menses, which she had noted were two weeks late. Two weeks later she developed morning nausea. At this time her urine contained more albumin than usual and there was a considerable amount of pus and blood. A week later, pelvic examination revealed no positive signs nor did her breasts show any changes of pregnancy. We then made an Abderhalden test with placenta substrate which was positive. As it was necessary for the pregnancy to be terminated, the attending physicians performed a curettage under gas-oxygen anæsthesia, and removed a fœtus estimated to be of ten weeks' development. She had a steady convalescence after one week of serious illness and was up and about in three weeks.

In a series of cases of angiosclerosis, we obtained positive reactions with artery and in several instances with adrenal substrata.

In the experimental tests on dogs we believe that our evidence in the foregoing cases substantiates the results of other writers who hold that the protective ferments show specificity in the Abderhalden dialysis reaction.

In a series of thyroid transplants we have been able in 17 instances out of 23 to show positive reactions with suprarenal and in 2 instances a positive reaction also with pancreas, but only 1 positive reaction with spleen. All of our specimens of blood taken from animals following the transplantation of organs with

ABDERHALDEN REACTION FOLLOWING TRANSPLANTATION OF ORGANS

Dog Number	Ccm. Each Test	Time of Dialysis (Hours)	Serum Control	Serum +Adrenal	Serum +Spleen	Serum +Pancreas	Serum +Pituitary Gland	Serum +Thyroid
214	1.0	20	o	+++	+			
180	1.5	24	o	+	o			
180	1.0	24	o	+	o			
191	1.0	24	o	+	o			
214	1.0	24	o	+		++		
282	1.0	24	o	+		+		
282	1.0	24	o	+				
282	1.0	24	o	+				
214	1.0	24	o	++				
282	1.0	24	o		o			
214	1.0	24	o				+	
269	1.0	24	o	o				
214	1.0	24	o			+		
214	1.0	24	o	+				+
268	1.0	24	o	o		+		
141	1.0	20	o	++	+			
114	1.5	24	o	+				
114	1.5	24	o	++				
114	1.5	24	o	o				
132	1.5	24	o	++				
164	1.5	24	o	+				
192	1.5	24	o	++				
242	1.5	24	o	+				

the use of blood-vessel suture reacted positive with the substrate artery.

We conclude that the test is of great value in confirming clinical observations, and that those who rely upon laboratory tests alone for diagnosis are bound to be disappointed, not on account of the inferiority of the test but of its necessary limitations.

To those who kindly contributed specimens we desire to express our thanks.

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FURTHER STUDY OF IRREGULAR KIDNEY VESSELS AS FOUND IN ONE HUNDRED EIGHTEEN CADAVERS

By R. R. RUPERT, M.D., Chicago
Instructor in Anatomy, University of Illinois

VARIATIONS in the renal arteries and veins have been the subject of repeated study, and a voluminous literature exists. The subject, however, is well worthy of further study, not only from the morphological, but more especially from the surgical, standpoint.

The present study was begun in 1912 and the data accumulated during one year was published in 1913. The additional data which has been gathered since that time is presented in the following pages.

The specimens on which this paper is based were removed from dissecting-room material. The blood-vessels and ureters were sketched *in situ*. Then the kidneys were removed with the aorta, vena cava, and ureters attached. By this method the observations made on the structures *in situ* were confirmed and elaborated. Altogether the kidneys from 118 cadavers were studied; 103 were males and 15 were females. The males included 98 whites and 5 negroes; the females included 13 whites and 2 negroes. Of the cadavers showing variations in the renal vessels, there were 57 males and 15 females; the males included 56 whites and 1 negro, the females 13 whites and 2 negroes. In the 118 cadavers there were 72, or 61 per cent, which showed either a unilateral or bilateral variation of artery or vein, or of both.

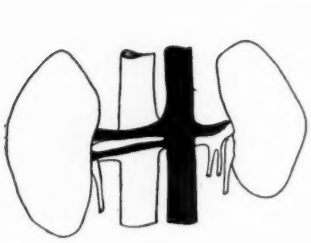
The great majority of texts lay little emphasis upon variations in blood-vessels. There are, however, a number of special articles scattered through the literature which deal more or less exhaustively with these variations.

I am especially indebted to Dr. Charles Davison and Dr. T. A. Davis for many helpful suggestions in the work, and to Dr. A. C. Eycleshymer for his help in the preparation of the article.

No attempt has been made to gather all the literature on the subject. The list of papers and abstracts available date from 1857 with the publication of the first volume of Henle's *Berichte über die Fortschritte der Anatomie*.

Long before this time many observations had been made. Du Breul in 1847, in his *Anomolies arterielles*, recorded many variations. Hyrtl, Kunst, and others recorded such rare variations as the hepatic arising from the renal. Blancherd in 1869 presented a case with four renal arteries. Portal reported a case in which there was a single trunk arising from the aorta which bifurcated into a right and left renal. Merkel, Otto, and others observed cases in which there were five arteries on one side. Otto describes a case in which a branch from the common iliac supplied the kidney. These and other scattered observations led to more extended studies.

Macallister records numerous conditions under (1) variations in origin, (2) variations in branching, (3) variations in point of entrance, (4) distribution of branches. He finds that the kidney may be supplied by (*a*) arteria suprarenalis, (*b*) arteria lumbalis II, III, (*c*) hepatica dextra, (*d*) colica dextra, (*e*) iliaca externa, (*f*) iliaca interna, (*g*) iliaca media, (*h*) sacralis media. Under variations in branching he finds three or four to be the commonest number which enter the substance of the kidney. As high as ten have been observed. As to point of entrance, all enter the hilum. Under distribution of branches it was found that the renal usually sends branches to the suprarenal, sometimes to the diaphragm, right colon, pancreas, testis, and liver. Schmerber in 1895 found that in 100 subjects there were double renal arteries in 14 cases, and these were bilateral; but when found on one side only they were usually on the left side. He also records the renal as often arising from the spermatic.



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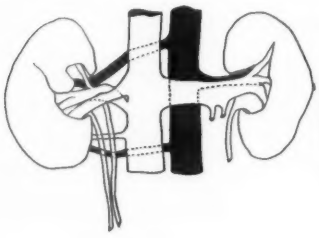

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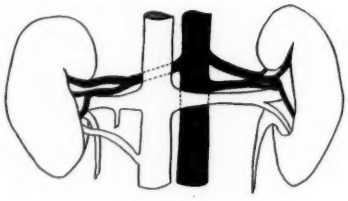

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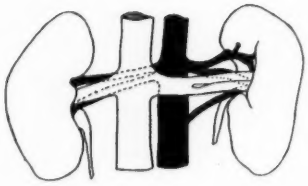

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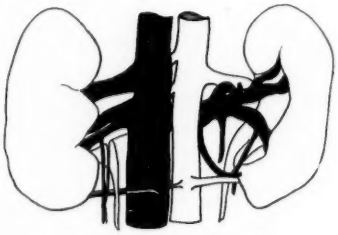
Anterior View, No. 28, Table 45.



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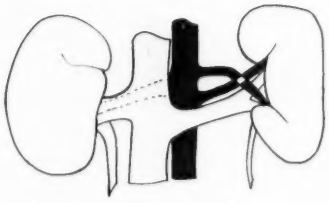

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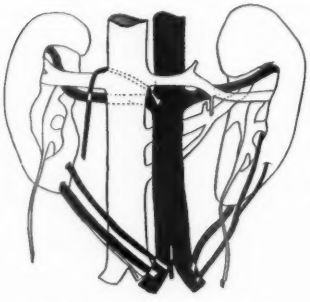

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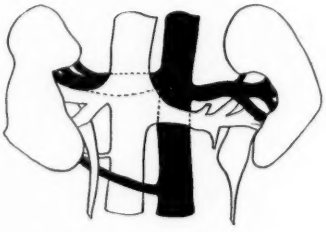

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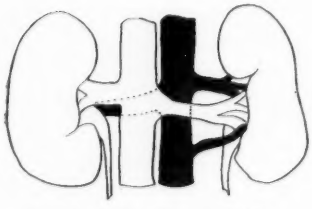

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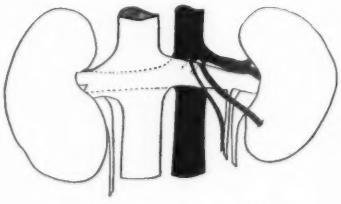

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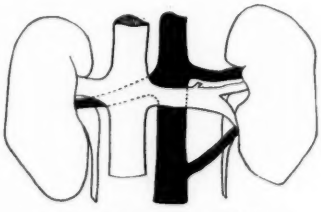

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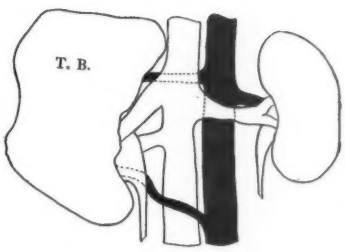

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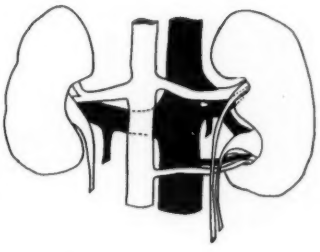

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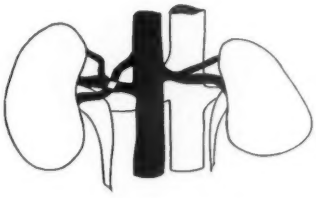

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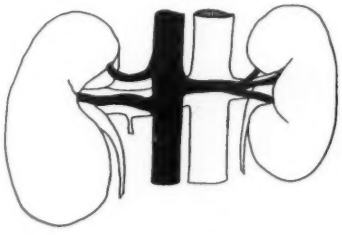

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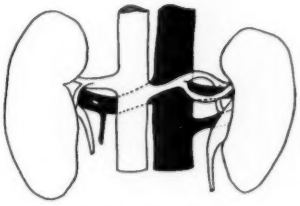

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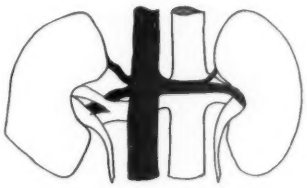

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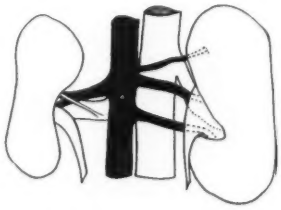

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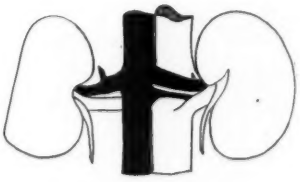

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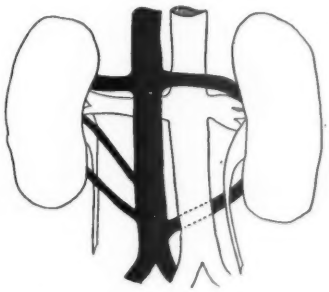

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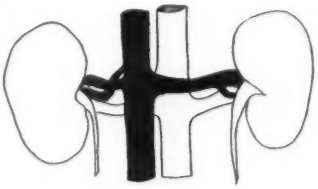

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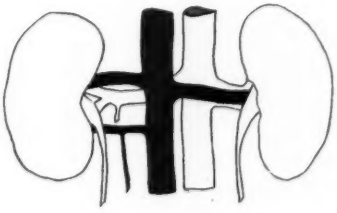

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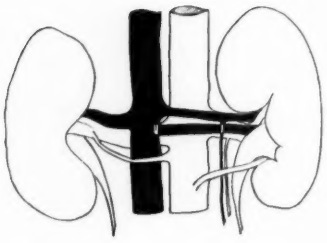

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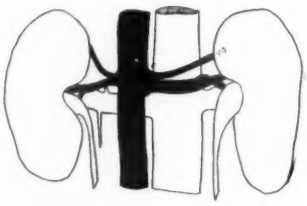

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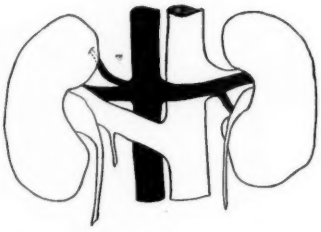

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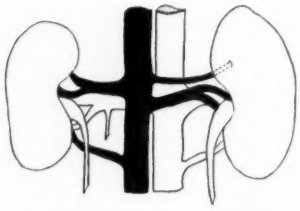

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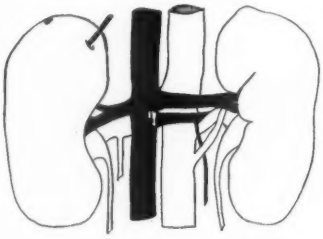

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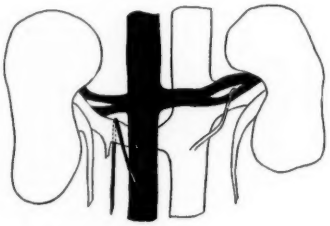
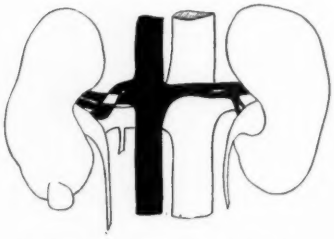
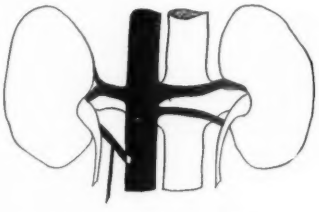


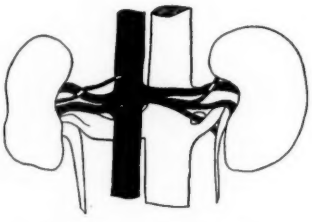
Posterior View, No. 23, Table 27.



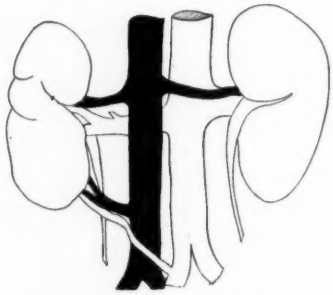
Posterior View, No. 24, Table 28.



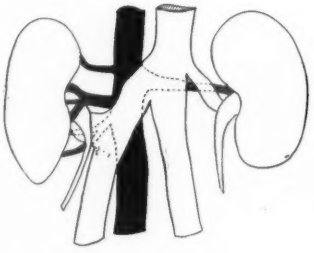
Posterior View, No. 25, Table 30.



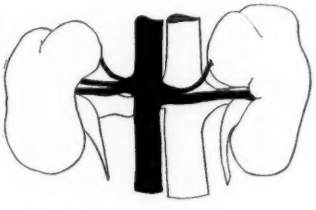
Posterior View, No. 26, Table 31.



Posterior View, No. 27, Table 32.



Posterior View, No. 28, Table 45.



Posterior View, No. 29, Table 40.

The modern textbooks give practically the same description of the renal arteries as Macallister, while Corning, in addition to the text, gives some very fine plates of the more extreme types in variations, such as are represented by Nos. 16 and 43 of this series.

It has been said that "most commonly anomalous vessels are found at the upper extremity of the kidney." The following table shows the contrast between superior and inferior polar arteries of this series:

Superior pole only, 20 cadavers (16+per cent); 20 kidneys: 12 right, 8 left (Nos. 57, 64, 44, 32, 12, 7, 13, 42, 69, 20, 61, 45, 58, 36, 26, 48, 3, 68 inches, 37 inches, 34 inches).

Inferior pole only, 11 cadavers (9+per cent); 10 kidneys: 3 right, 7 left (Nos. 49, 50, 18, 21, 4, 27, 60, 33, 30, 18, 7, 43 68, inches, 37 inches, 34 inches.)

Nos. 21, 4, 27, 30, 18, 7, and 43 show anomalous polar veins: 8 right and 2 left.

Superior and inferior pole, same side, 5 cadavers (4+per cent) 5 kidneys: 2 right, 3 left. (Nos. 66, 46, 21, 52, 28).

Superior poles, both sides, 5 cadavers (4+per cent) 10 kidneys (Nos. 6, 5, 9, 19, 29).

Inferior poles, both sides, 3 cadavers (2+per cent) 6 kidneys (Nos. 30, 16, 43).

Superior and inferior poles, both sides, none.

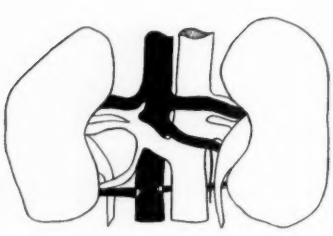
The renal veins in this series did *not* "share the frequency of anomalous distribution with the arteries."

In 63 cadavers (53+per cent), 77 kidneys showed variations in the arteries: 21 right, 28 left, 14 both sides.

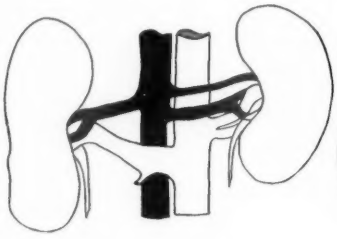
In 31 cadavers (27+per cent), 26 kidneys showed variations in veins: 30 right, 1 left, 3 both.

In my previous article all cadavers showing variations of the *veins, on one side only*, had this variation on the right side. With one exception this is true in this series. Eight cadavers showed anomalies of the veins only, and these anomalies were all on the right side. The axis type of bifid arteries corresponds to the "precocious division" of Gerard.

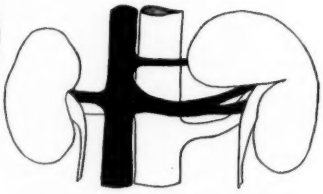
No.	Arteries		Veins		Axis		Two Artery Type
	Left	Right	Left	Right	Left	Right	
2		2					
4		2		3			Ureter, double 5 inches long to point cut.
5	2					2	
6	2						
7	2			2			
9	2						
15	2						
17	2						
18		2	2	2			Right spermatic artery originates from right suprarenal artery. Right spermatic vein empties into renal vein. Left renal vein divides and empties into vena cava at two points.
21	2	2		2			
22		2		2			Right spermatic artery originates from inferior renal Artery size knitting needle enters superior pole left kidney from suprarenal artery.
25	2	2					Left spermatic artery from inferior renal artery.
27	2		2				Inferior vein on left extends from inferior pole of kidney to left common iliac vein.
31		2		2			Left renal vein posterior to aorta.
32		2					
34	2	2		2			
35	2						
39	2						
40	2	2		2			Branch left renal vein winds around artery before joining vena cava.
41		2					
44	2						
57		2		2			Superior renal artery gives off three branches from an axis; right veins form an axis.
71		2		2			Variation in entrance of left renal vein into vena cava.
67	2						
66	2			2			
64	2	2					
59	2		2				Left renal vein divides to enter vena cava at two different points.
55	2						
53	2						
52		2		2			Inferior renal artery anterior to vena cava. Superior renal artery posterior to vena cava.
51		2		2			
50	2						
49	2						
47	2						
46		2		2			Inferior renal artery anterior to vena cava.
63		2					Left renal vein divides to enter vena cava at two separate points.
14				2			
	23	19	3	15	0	1	



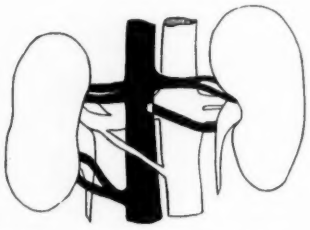
Posterior View, No. 30, Table 43.



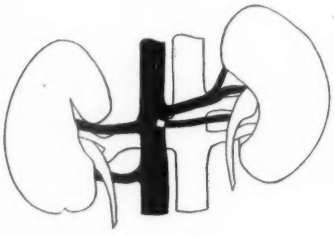
Posterior View, No. 31, Table 44.



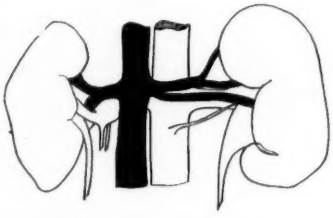
Posterior View, No. 32, Table 6.



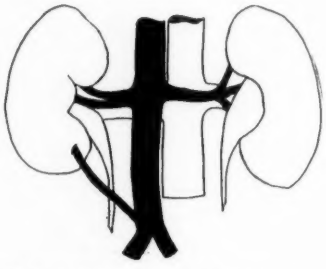
Posterior View, No. 33, Table 7.



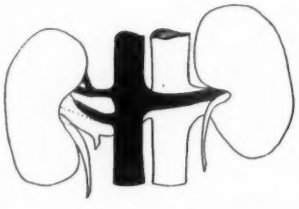
Posterior View, No. 34, Table 5.



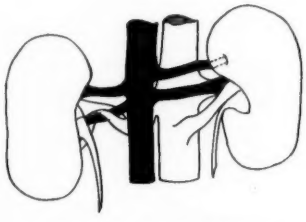
Posterior View, No. 36, Table 1.



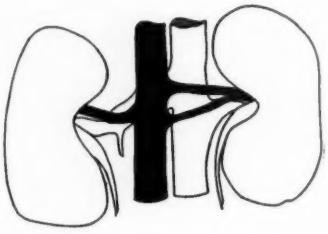
Posterior View, No. 37, Table 9.



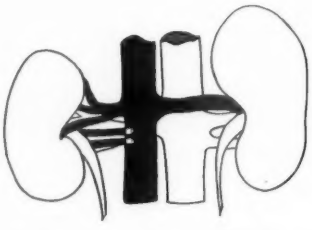
Posterior View, No. 39, Table 13.



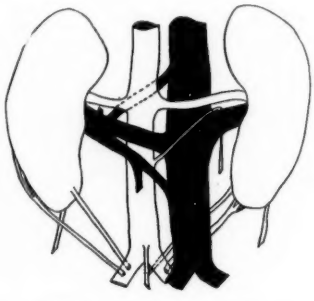
Posterior View, No. 40, Table 11.



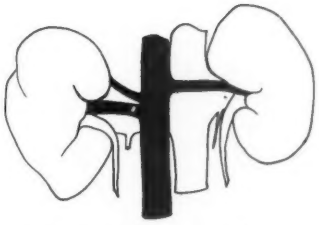
Posterior View, No. 41, Table 37.



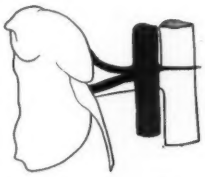
Posterior View, No. 42, Table 12.



Posterior View, No. 43, Table 8.

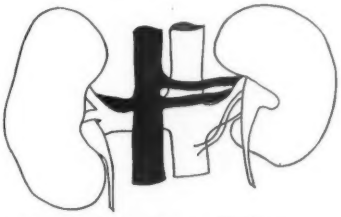


Posterior View, No. 44, Table 33.

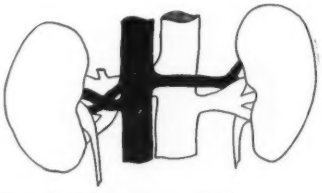


Posterior View, No. 45.

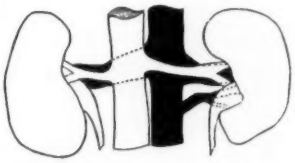
Posterior View, No. 48, Table 7.



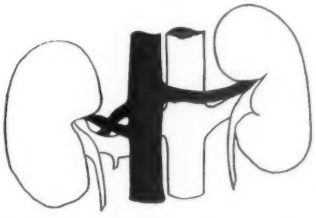
Posterior View, No. 51, Table 15.



Posterior View, No. 53, Table 17.

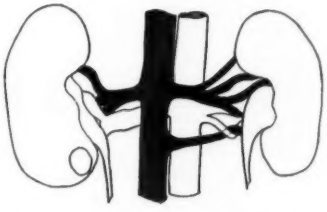


Posterior View, No. 54, Table 18.

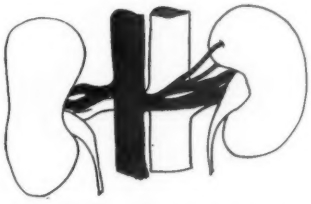


Posterior View, No. 55, Table 19.

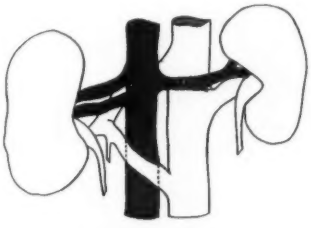
Posterior View, No. 56, Table 20.



Posterior View, No. 57, Table 24.

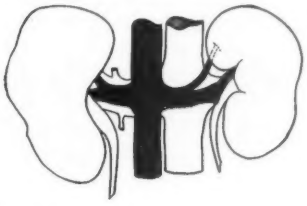


Posterior View, Nos. 58 and 70, Table 25.

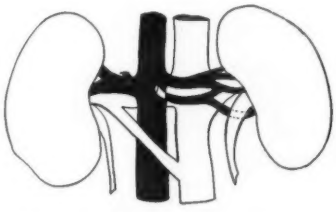


Posterior View, No. 59, Table 27.

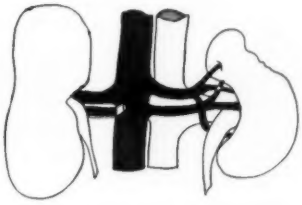
Posterior View, No. 60.



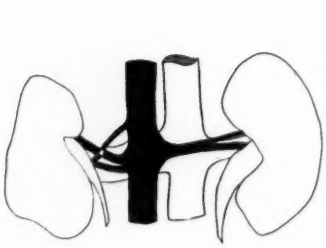
Posterior View, No. 61, also 38.



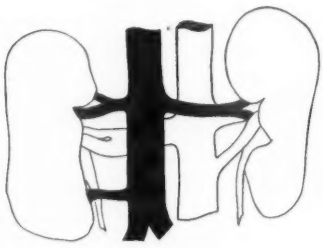
Posterior View, No. 63, Table 32.



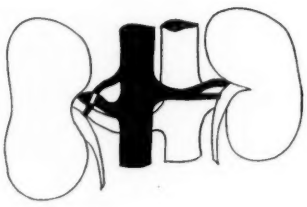
Posterior View, No. 64, Table 33.



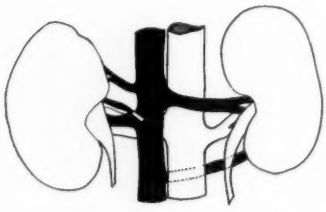
Posterior View, No. 65, Table 42.



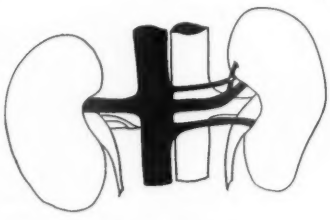
Posterior View, No. 66, Table 39.



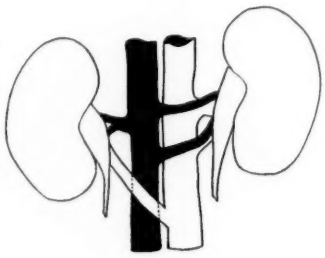
Posterior View, No. 67, Table 37.



Posterior View, No. 68, Table 35.



Posterior View, No. 69, Table 38.



Posterior View, No. 71, Table 43.

ARTERIES

Left side only	21
Right side only	8
Both sides	8

VEINS

Left side only	6
Right side only	30
Both sides	0

VEINS AND ARTERIES IN SAME CADAVER

Left side	2
Right side	12
Both sides	2

VEINS ONLY

Left side	0
Right side	8
Both sides	0

Attention is called to three specimens (Nos. 68, 37, 34), which are rather difficult to classify. They are listed under "superior polar type" and "inferior polar type" on that account.

Two specimens show that one of the irregular arteries makes one complete twist around one of the branches of the renal vein or vice versa.

Seven specimens, a rather large percentage, it seems to me, show relatively the same peculiar arrangement of the renal vein, or veins, as shown by Specimen No. 63. Eleven specimens, including the seven above, show variation in arteries or veins passing anterior to, or posterior to, the vena cava or aorta, when their normal position should have been the opposite of the one occupied—Nos. 46, 63, 18, 27, 52, 59, 16, 68, 30, 60, 43.

The cadavers from which these specimens were obtained were used in two lots; i.e., first and second semester, and the tables when placed in position in the anatomical laboratory were arranged in groups of 20 and numbered consecutively, beginning at No. 1.

It is of interest to note the sequence of numbers of the tables holding a cadaver whose kidney or kidneys show variations in renal blood-vessels. The first group of 20 cadavers — 40 kidneys — gave 11 variations. Every cadaver on the last 6 tables, Nos. 15 to 20 inclusive, showed a kidney or kidneys having an irregular blood-vessel.

The second group of 20 cadavers — 40 kidneys — showed 12 variations in blood-vessels. The third group of 20 cadavers — 40 kidneys — showed 17 variations, every

No.	Arteries		Veins		Axis		Three Artery Type
	Left	Right	Left	Right	Left	Right	
12	3	2					Two arteries from an axis superior.
13		3					
16	3	2					Inferior arteries on both sides originate near bifurcation of aorta. On left, inferior artery is anterior to vena cava. On right, superior artery posterior to vena cava.
28	3						Common iliacs join opposite hilum of kidneys to form vena cava.
30	2	3		3			Two superior arteries on right pass posterior to vena cava. Inferior artery passes anterior to vena cava.
33	3	2	2	2			Left renal vein branches into two divisions.
37	3						Upper two arteries form an axis.
42	3			2			Superior artery gives off three branches from an axis.
43	3	3	3	2			Two left inferior arteries, branches of left common iliac. On right one artery from right common iliac and one from median sacral.
69		3					
68	3	2					Right superior artery posterior to vena cava. Right inferior artery anterior to vena cava.
65	3						Two inferior arteries from an axis.
60		3		2			Two superior arteries from an axis. Left renal vein divides to enter vena cava at two points.
26		3	2		3		Left inferior arteries from an axis.
	10	10	3	5	1	0	

No.	Arteries		Veins		Axis		(Artery) Type
	Left	Right	Left	Right	Left	Right	
19	2	2					
20	2						Left renal vein posterior to aorta.
23	2			2			Left spermatic vein passes up and over left renal vein.
24	2						
29	3	2					
36		2		2			
38	2						
45	2						Right renal artery small cordlike structure congenital absence of right kidney. Unicornate uterus.
70	2	2					
61		2					
58		3					
56	2						
	9	6	0	2			

Number	Left	Right	Veins Only
1		2	Accessory vein small.
3		2	Accessory vein small.
8		2	Accessory vein small.
10		2	Accessory vein small.
11		2	Accessory vein small.
62		2	
48		2	Right artery an axis giving off three branches. Right kidney congenitally small.
54		2	
	0	8	

cadaver on tables 50 to 59 inclusive showing a variation in blood-vessels. The fourth group of 20 cadavers — 40 kidneys — showed 13 variations, every cadaver on tables 73 to 78 inclusive showing variations in blood-vessels. The fifth group of 20 cadavers — 40 kidneys — showed 10 variations, the sixth group of 18 cadavers — 36 kidneys — 9 variations, cadavers on tables 104 to 108 inclusive showing variations in blood-vessels.

Those cadavers showing a variation in the renal blood-vessels are marked with a plus sign; those not showing any variation are designated by a minus sign.

In this series of 118 cadavers there were no movable, pelvic, or horseshoe kidneys found. There was one, No. 48, right, kidney congenitally small, being 6.5 x 3.5 x 2 cm. in its greatest measurement, this variation, according to Treves, occurring once in four thousand cases.

One cadaver, No. 45, showed the congenital absence of one kidney, which variation Treves also mentions as occurring once in four thousand cases. The opposite kidney in this specimen has two arteries. This cadaver also had a unicornate uterus, the opposite horn of the uterus being missing

Table No.		Table No.		Table No.		Table No.		Table No.	
1	+	26*	*	51	+	76	+	101	−
2	−	27	+	52	+	77	+	102	−
3	−	28	+	53	+	78	+	103	−
4	+	29	+	54	+	79	−	104	+
5	−	30	−	55	+	80	−	105	+
6	+	31	−	56	+	81	−	106	+
7	+	32	+	57	+	82*		107	+
8	+	33	+	58	+	83	+	108	+
9	−	34	+	59	+	84	−	109	−
10	−	35	+	60	−	85	−	110	−
11	−	36	−	61	+	86	+	111	−
12	+	37	+	62	+	87	−	112	−
13	−	38	−	63	+	88	−	113	+
14	−	39	+	64	−	89	+	114	−
15	+	40*	*	65	−	90	+	115	−
16	+	41	−	66	+	91	+	116	+
17	+	42	+	67	+	92	−	117	−
18	+	43	+	68	+	93	−	118	+
19	+	44	+	69	−	94	−	119	+
20	+	45	+	70	+	95	+	120	−
21	−	46	+	71	+	96	+	121	−
22	−	47	+	72	−	97	+		
23	−	48	−	73	+	98	+		
24	+	49	−	74	+	99	+		
25	+	50	+	75	+	100	+		

* Prosected cadaver, not included.

on the right side showing the congenital absence of the kidney, the missing structures being represented by a retroperitoneal fibrous band about 1 cm. wide, extending from the region of the transverse fissure of liver, downward to the femoral ring on that side.

The interpretation of multiple renal arteries and the great variations found in their branching may be explained from the standpoint of embryology in that the permanent kidney of mammals must be considered as the posterior portion of the primitive excretory organ. The vascular supply of this is segmental, and there are indications of this segmental arrangement persisting in the extrarenal anastomoses of the arteries. Again, from the standpoint of comparative anatomy there are conditions which anticipate the variations. We know that in many of the reptilia there are multiple renal arteries. In the birds there are usually four to six pairs of renal arteries. We should therefore expect, both from ontogenetic and phylogenetic points of view, to find much variation in the renal blood-vessels of man.

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TREATMENT OF HAND INFECTIONS FROM AN ECONOMIC VIEWPOINT

BASED ON A STUDY OF 1600 CASES[1]

BY HARRY E. MOCK, M.D., CHICAGO

THE physician, if endowed with enthusiasm for his work, is constantly striving to the best of his ability to prevent disease and injury, to restore health in the shortest time possible, and to reduce the death-rate to a minimum: therefore, he is an economist of great value to the community.

Those of us engaged in emergency accident work for any industry are naturally trained, by the very nature of the work, to view every case from its economic standpoint. An accident occurs, and at once we plan the subsequent handling of the case with these four fundamental principles in mind:

1. How to prevent recurrence of accident.
2. How to aid recovery the quickest.
3. How to prevent permanent disability.
4. How to avoid fatal termination of case.

There is no selfish reason involved, but the welfare of the patient, the protection of the other employees, and the interests of the employer, all demand the careful consideration of these principles, purely and only, from an economic basis.

Certain complications following injuries must likewise be studied along these same lines, and chief among these is *infection*. Infections, as a rule, follow minor accidents, and minor accidents are by far the hardest type to prevent. Infections following minor injuries to fingers and hands are so common that these have been chosen to illustrate the great value of following the above economic principles in the treatment of these cases.

The part played by hand infections in the economy of the industrial world is shown by the following statistics and statements from various industries and accident insurance companies:

1. From 4971 accidents, 11 per cent became infected. Total disability from these accidents was 13,000 days, and 20 per cent of this was due to the infections.

2. From one of the stock-yard plants: 75 per cent of disability from hand injuries is the result of infections; 25 per cent of disability from hand infections is due to other causes, such as broken bones, etc.; 90 per cent of these hand infections report late, after the infection has developed; 75 per cent of their hand deformities are the result of infections.

3. Figures obtained from the claim departments of five of our largest accident insurance companies:

a. 15 per cent of the total disability is due to hand injuries. In 20 per cent of these hand injuries, the disability is due to infections.

b. 7 per cent to 9 per cent of the total disability from all accidents is due to hand infections.

c. From 1,000 consecutive cases, 5.7 per cent of the total disability was due to hand infections.

d. From 10 to 20 per cent of the total disability is due to hand infections. It depends on the type of work done by insured. When engaged in heavy work, where the injuries are usually serious, the infections are less, but if engaged in light work, where minor accidents are the rule, the infections are greatly increased.

e. Of all hand accidents, it is estimated that 65 per cent requiring disability are the result of minor injuries which have become infected; 35 per cent requiring disability are due to other injuries, as broken fingers, lacerations, crushing injuries, etc.

In talking with a number of company surgeons and managers of claim departments, I find that no definite statistics are available on this subject. They all agree, however, that —

1. Hand infections cause a high percentage of their disability.

2. Over 50 per cent of their hand deformities are the result of infected injuries.

[1] Read before the Kankakee (Illinois) County Medical Society, February, 1915, and the Illinois Manufacturers' Association, March, 1915.

3. A great many amputations result from neglected, infected fingers.

4. Hand infections are usually the result of minor injuries, such as pin pricks, nail wounds, splinters, scratches, small cuts, cracked hands, blisters, contusions, and abrasions. Such minor cases, as a rule, do not report to the doctor until the infection has developed.

5. Severe hand injuries, such as extensive lacerations, or severe crushing injuries, seldom become infected. The nature of these injuries is such that the patients are forced to consult a doctor at once.

6. That early treatment of all accidents, no matter how slight, would reduce infections to a marked degree.

PREVENTION

Prevention of infections is one of the most fertile fields of endeavor open to the company surgeon. It is the "Safety First" movement for the injured. A careful study of the etiology of every infection will show that the majority are due to preventable minor accidents, and by a removal of these causes a great reduction in infections will ensue. As an example, the lining of bins which had become loosened was the frequent cause of injuries which became infected. In every case, a notice was sent to the manager, pointing out the preventable nature of this accident, and in one year the injuries from this source were reduced from 75 to 10. The same procedure was followed in the case of broken baskets, exposed ends of wire, nails on the floor, pins in packages, etc., all resulting in a decrease in minor accidents and therefore in infections.

Tincture of iodine is the greatest protection against infection that can be used. Every industry should supply each department with a bottle of tincture of iodine and another bottle containing applicators, and should instruct each employee to paint every wound, no matter how slight, with the tincture of iodine *at once*, even before reporting to the doctor. The importance of its use should be pointed out to the department foremen again and again, in order that they may instruct each new employee as to its value. In 1909, impressed by the great number of hand infections reporting to the doctor's office in a large industry, I installed this use of iodine as a preventive measure. Immediately, there was a reduction of 38 per cent in the number of infections. Practically all of the infected cases failed to use iodine at once. The following figures taken from last year's report show the importance both of using iodine and of reporting to the doctor at once for dressing:

From 3,000 accidents, 44 per cent reported at once, and 41 per cent used iodine at once; 43 per cent reported late and failed to use iodine; the remainder were cases where its use was not indicated.

From the above number there were 654 infections: 12 of these used iodine and reported at once; 24 failed to use iodine, but reported at once; 618 reported from one day to one month after receiving the injury with the part infected — average time was from one to three days afterward; of this number, 40 per cent used iodine somewhat later, while 60 per cent failed to use it at all.

The 36 infections that used iodine or reported immediately were all very slight and did not require opening, while 440 of the group who failed to use it or reported late required incisions, thus necessitating 1912 days of disability and further decreased efficiency by working with a finger or hand bandaged for several days. A large percentage of these cases occurred among new employees.

The importance of early reporting to the doctor for a dressing is not only demonstrated by the above figures, but by the fact that major injuries, which force the employee to report at once, seldom become infected.

The use of hydrogen peroxide, bichloride wash, or soap and water on a fresh wound is never indicated. These methods tend to scatter the dirt and infection throughout the wound. Hydrogen peroxide especially, by its foaming, expansive power, carries dirt deeper into the wound without killing the germs of infection. Even in the use of iodine, the effort is not so much to cleanse the wound, as to inhibit the growth of any germs that might have been introduced.

Another form of prevention is the removal

of all predisposing causes for infection in the employees themselves. The generally run-down, anæmic, undernourished individual, or those suffering from chronic diseases, are more prone to injuries and injury infections. Thus, the discovery of the diseased employee by a periodical medical examination of all employees is a valuable adjunct to any system of prevention. By proper advice many of these diseased conditions can be overcome; a change of work may be indicated in other cases, and the regulation of the employee's mode of living, both at work and at home, and as regards outdoor exercise, will correct a great many of the anæmic, undernourished, and run-down conditions. In girls, we frequently see recurring infections in the same individuals. A study of the case will reveal a marked anæmia, the correction of which overcomes her tendency to infections.

Tonsillitis, one of the chief causes of sick disability among employees, also plays a marked rôle in the cause of infections. In the winter months, when tonsillitis is the most prevalent, our infections are correspondingly high. The coincidence of tonsillitis and finger and hand infections was noted so often that I made a careful bacteriological study of a series of these cases, and, as a rule, the same germ was found as the cause of both.

The following table shows this relationship. Note the increase in hand infections with the increase in tonsillitis. (These figures are taken from the same working force, with the same working conditions prevailing.)

January and February, 1913. Total number cases of tonsillitis	327
January and February, 1913. Total number cases of hand infections	83
Total days disability from hand infections	63
Number of hand infections having tonsillitis at time or just before infection developed	15, or 18 per cent

In 1914, we had in Chicago a serious epidemic of tonsillitis, of the streptococcic type.

January and February, 1914. Total number cases of tonsillitis	603
January and February, 1914. Total number cases of hand infections	117
Total days of disability from hand infections	208
Number of hand infections having tonsillitis at time or just before infection developed	32, or 27.9 per cent

Fig. 1. Lymphangitis of the arm from an infected abrasion on back of hand. Thirty-six hours in the hospital with continuous hot dressings relieved this condition without surgical interference.

The greatly increased disability in 1914 was due to 24 very serious cases with marked lymphangitis and tenosynovitis, all of whom had tonsillitis. Twelve of these were due to a hæmolytic streptococcus, and the same organism was found in the patient's tonsils. Twelve others had a marked lymphangitis, and while the organism was not ascertained, yet these were undoubtedly streptococcus infections and closely related to the tonsillitis.

The removal of the tonsils when diseased, therefore, would not only stop the sick disability and the spread of the disease throughout a department as an epidemic, but would be a great preventive measure against infections.

A further and very important factor in the prevention of infections is a suitable emergency office, where the most aseptic surgical treatment can be rendered.

Thus the most valuable preventive measures in the economic care of infections are —

1. The use of tincture of iodine at once as a prophylactic measure.

2. The sending of every injured employee to the doctor for immediate dressing.

3. Removal of external causes for accidents — found in the working place.

4. Removal of predisposing causes for infections — found in the employees.

The following table shows the percentage of all infections as compared with the total number of accidents each year, for the last three years.

Year	Number of Accidents	Number of Infections
1912	2693	772, or 28.6 per cent
1913	4383	329, or 7.5 per cent
1914	4971	654, or 11.0 per cent

Fig. 2. Thenar space abscess from a neglected knife-wound of the thumb. Through-and-through drainage under a general anæsthetic and hospital treatment for three days gave a prompt recovery.

The fact that the total number of infections has decreased so markedly in the last two years, notwithstanding a 40 per cent increase in the number of accident cases reporting to the doctor's office, is due chiefly to the enforcement of the rules that every accident case must report at once to the doctor, and, when indicated, must use iodine at once.

ACTIVE TREATMENT

When an infection has once developed, the best medical treatment is at times the most expensive, but in the long run, it is the most economical. Too often, a doctor hopes to save his patient loss of time, or, if he is a company surgeon, he hopes to treat the case and still keep him at work: thus he adopts what at first seems the most economic line of treatment, but, by so doing, frequently temporizes with the infection. The death-rate from hand infections among the medical profession is notoriously high. I believe this is due not so much to the peculiar nature of the doctor's work, wherein he is brought into close contact with diseased conditions, as to the fact that most doctors temporize with an infection which they have contracted, rather than adopt active treatment at once.

From a careful study of 1,600 cases of finger and hand infections and their complications during the last three years, I am convinced that a radical form of treatment of all hand infections is the most economical plan that can be adopted.

The initial cost of such treatment will exceed a temporizing effort, such as opening an infection in the office and allowing the patient to go about his duties, but the length of treatment and the complications developing from the latter method will far exceed that which follows the treatment of all infections as serious from their inception. In dealing with this subject from an economic viewpoint, it is not the actual cost of medical services which is referred to, but the actual economy to the patient and to the concern for which he works. The most perfect line of treatment must give —

1. The shortest disability, with a minimum amount of suffering, and the fewest hardships to those dependent upon the patient;

2. It must prevent permanent deformities, such as loss of function, or loss of fingers;

3. It must reduce the death-rate to a minimum.

These 1,600 cases of hand infections were chiefly the result of minor accidents, such as the following, named in their order of frequency: pin pricks, splinters, abrasions from baskets, boxes, bins, etc.; lacerations from knives, scissors, and other sharp utensils; bruises and contusions, nail wounds, scratches from tin and wire. The greater portion of these infections were very slight causing no loss of time from work, and requiring from 3 to 10 dressings. Nevertheless, there was a certain disability connected with them, as an employee with a bandaged finger or hand has less working capacity than an unhampered employee. Therefore, reduction in the total number of infections means a marked saving in this form of disability. It has been further reduced by careful attention to the simplest, yet adequate, dressing which can be applied. A certain number of the

Fig. 3. Tenosynovitis of middle finger, with middle palmar abscess—result of cutting finger on steel tag. Was given ambulatory treatment, with an effort to drain abscess through small incision on flexor surface of finger. Proper early drainage of the synovial sheath of the middle finger would have prevented this condition.

above infections became serious, requiring considerable treatment either at home or at the hospital, and caused an actual loss of time from work. Thus, the 1,600 cases may be classified as follows:

a. Mild, or causing no loss of time, 1,189, or 74 per cent.

b. Serious, or causing loss of time, 411, or 26 per cent.

In order to arrive at the best and most economic treatment of these hand infections, it is necessary for us to study the 411 cases from the above table which were serious enough to require actual disability.

One of two plans of treatment was adopted in every case of hand infection; namely, ambulatory treatment, or hospital treatment. The ambulatory care consisted in opening the infected part at the doctor's office and allowing the patient to go home, reporting to the office for subsequent dressings. Frequently these infections were incised by the use of a local anæsthetic, but a general anæsthetic was never administered in the doctor's office. When necessary, instructions

Fig. 4. Deformity of hand—result of generalized cellulitis of forearm, and involvement of radial and ulnar bursæ. Initial injury: Slight contusion at base of palm. Early hospital treatment and proper diagnosis of the location of pus would have prevented this deformity.

were given to the patient as to the use of hot dressings at home, and a nurse would call to see that these instructions were carried out. Naturally these infections were not as serious as those given hospital treatment, but in spite of this fact their average disability was greater. The absolute rest obtained by hospital treatment would cause more rapid recovery of these cases, but the idea of going to a hospital for a small, minor infection does not appeal to most patients.

When a hand infection showed signs of becoming at all serious, or threatened complications were apparent, we insisted upon hospital treatment. Here the infection could be opened under a general anæsthetic of nitrous oxide gas, and the patient kept absolutely quiet in bed, with continuous hot, moist dressings applied until the acuteness of the condition had subsided. Likewise, many cases of threatened serious infection could be aborted and the necessity of opening these overcome by sending the patient to the hospital, giving him absolute rest in bed, preventing the movement of the infected part, and applying continuous hot packs for 24 or 48 hours.

The use of a general gas anæsthetic is one of the most valuable features of this hospital treatment when it is necessary to operate on these hands. The work of the operator is much more thorough, and incisions into the infected part are larger and better drainage is established. Wide-open, radical treatment of these infections means a much more rapid

Fig. 5. Deformed hand—result of splinter wound at base of thumb. This deformity resulted from trying office treatment and from a wrong diagnosis of the location of the pus. The middle palmar space was opened, when the thenar space was involved. As a result, the middle palmar space and ulnar bursa both became infected. No pus was found on opening middle palmar space. Twenty-four hours later patient entered hospital, and through-and-through drainage of thenar space revealed location of pus.

recovery; therefore the advantage of this procedure. The history of the treatment of hand infections is one of following the pus by making additional incisions. Frequently an infected hand is operated upon two, three, or even more times; whereas, if sufficient drainage is established at the first incision, subsequent openings are not necessary. Ninety-five per cent of the infected hands requiring two or more operations occur in those cases given office treatment.

Besides reducing disability, a number of these serious hand infections would have resulted in permanent deformities if this radical form of treatment had not been adopted early. The accompanying table demonstrates the great advantages of hospital treatment for hand infections as compared to ambulatory treatment:

From a study of the above facts, I am positive that *dangerous infections can be prevented and disability reduced by the early adoption of hospital treatment.* The reasons therefore are —

First, the patient can be kept absolutely quiet and under better control than at home. This is very essential, as most of these infections are accompanied by a low-grade fever.

Second, continuous hot dressings can be better applied by a trained nurse than by the relatives.

AMBULATORY VERSUS HOSPITAL TREATMENT OF SERIOUS HAND INFECTIONS

	Treated at doctor's Office and at Home	Treated at Hospital
Total number	253	146
Opened	210	78
Not opened	43 or 17%	68 or 46.5 %
Total loss of time from work	2790 days	1088 days
Average loss of time, per case	11.02 days	7.4 days
Permanent disability, as loss of function or member	0	2[1]
Deaths	0	0

[1] 25 per cent loss of function by stiff middle finger.
10 per cent loss of function by stiff thumb.

Third, better operations can be performed because of the general gas anæsthetic, thus reducing the length of treatment, and necessitating fewer second operations.

There are 12 very serious, complicated cases of hand infections from this series which are not included in the above table, as these were first given home treatment, usually by their family physician, and later, as a final resort, came under our care at the hospital. The serious results of this delayed treatment are conclusively demonstrated by the following chart:

SERIOUS, COMPLICATED CASES TREATED AT HOME AND TAKEN TO HOSPITAL AS FINAL RESORT

Total number	12
Opened	12
Total loss of time from work	379 days
Average loss of time per case	31.5 days
Permanent disability, loss of function or member	5[1]
Deaths	0

[1] First joint index finger right hand stiff, one case.
First and third fingers of right hand are flexed and stiff, one case.
Four fingers of right hand slightly flexed and stiff, one case.
Index finger left hand amputated, one case.
Index finger right hand amputated, one case.

A short résumé of two of these cases is typical of the entire series of twelve hand infections.

Miss K., 17 years old, pricked the middle finger of her right hand with a pin on January 5, 1914. This was two days after her employment. One of the witnesses suggested the use of iodine, but the patient did not think this necessary. January 10, five days later, she reported to the doctor's office with marked lymphangitis of the arm and considerable induration about the axilla, which extended on to the chest-wall, both subclavicularly and back to the border of the scapula. Swelling was quite firm and tender, but no inflammatory reaction of the skin was present. Temperature was 102°; pulse

100. Had a slight tonsillitis and pharyngitis, but otherwise the general examination was negative. There was no localized infection about the point of injury. The patient was sent to the hospital and under a general anæsthetic the axillary and the shoulder abscesses were incised at three different points, and tube and gutta percha drainage inserted. At least 8 ounces of thin, yellowish pus was evacuated. Large hot boracic acid dressings were applied to the site of operation and a second large hot dressing applied from the fingers to the axilla over the site of the lymphangitis. Subsequent course: In spite of the evacuation of the pus, the temperature continued to rise. The second day the temperature was 103°, pulse 120; third day, 103½°, pulse 120; fourth day, 105°, pulse 140. The patient was exceedingly sick and showed all the signs of a general systemic infection. The fifth day temperature was 104°, pulse 120; the sixth day, temperature 100° to 102°; and from this time on it gradually subsided, until at the end of two weeks it reached normal and remained there. On the third day, a stock streptococcus vaccine was injected, and on the fourth day, a small dose (50 million) of autogenous vaccine, which had been prepared, was injected. A slightly larger dose of autogenous vaccine was given on the sixth day, and again on the ninth day. These vaccines were repeated every four days for four more doses. She left the hospital at the end of 3½ weeks, and recovery was complete at the end of five weeks. The neglect of this minor injury and the late reporting after the trouble had started were the chief reasons for this girl's serious sickness.

Mr. E., an old employee, received a slight contusion of the hand on March 4, 1912. The cause of the accident was unknown. He had been under the care of his family physician because he did not think his work was responsible for the injury. The hand at first became swollen, then the forearm, which was badly inflamed and very tender. This swelling increased until his family physician was called on the fourth day. Three small incisions were made on the flexor surface of the forearm and were extended through the skin to the fascia. A little serous exudate was found, but no pus. These incisions became infected, and superficial abscesses developed on the forearm during the next ten days, which were opened and drained by small incisions. The swelling in the arm increased to an immense size and the entire forearm assumed a dark-red, brawny appearance. The patient came under my care March 18 and was taken to the hospital. A diagnosis of diffuse cellulitis of the forearm was made, with large collections of pus in both the ulnar and radial bursæ and the intramuscular spaces. Under a general anæsthetic, large incisions were made at each side of the forearm, just above the wrist-joint, and the ulnar and radial bursæ drained by through-and-through drainage. A large incision was then made through the upper two-thirds of the forearm, slightly to the ulnar side of the middle of the flexor surface. From this incision, all intramuscular abscesses were opened and drained. Infection was found to be a staphylococcus pyogenes aureus, and autogenous vaccines were made and used for several weeks. This man ran a temperature from 99° to 102°, with a weak, thready pulse of 110 to 130 for at least six weeks. His was the typical picture of sepsis. Acute nephritis developed, but gradually disappeared with recovery from his infection. For several days we despaired of this man's life. Recovery was practically complete about the middle of June, some three months later. Permanent deformities remain in this case. His four fingers are flexed about 25 per cent, and can not be completely extended nor closed.

This man's long disability, loss of function in the fingers, and the narrow escape from death were all the result of neglecting a simple injury, trying ambulatory treatment when hospital treatment should have been instituted together, with inadequate drainage during the early course of the disease (Fig. 5).

The remainder of the cases in this group all neglected prophylactic measures at the time of the minor injury; a few were given first aid by fellow employees, as attempted removal of a splinter from the hand, in which case a portion of it was left in; all reported to the doctor from three days to one month after receiving their injuries; and seven were given office treatment by their family physicians for a few days before being sent to the hospital. The five cases of permanent deformities, two with loss of fingers, are the direct result of the above negligence.

ECONOMIC VALUE OF PROPER DIAGNOSIS OF LOCATION OF PUS AND PROPER SURGICAL INTERFERENCE IN HAND INFECTIONS

Many cases of prolonged disability and also of permanent deformities result from a wrong diagnosis of the type of infection and a lack of understanding as to the location of the pus, and inadequate surgical interference — either too small incisions, or at times too large or too many incisions. Some of our cases of serious deformities come under this heading. Kanavel has demonstrated conclusively that there are certain definite spaces where infection, entering at various points on the hand, tends to spread. The most important of these spaces are —

1. The synovial sheaths about the tendons — the commonest site for the more serious forms of hand infections.

2. The lumbrical and subaponeurotic space at the edge of the palm, where the so-called "collar-button" abscesses form.
3. The thenar space.
4. The middle palmar space.
5. The hypothenar space.
6. The radial bursa.
7. The ulnar bursa.

Through the last two spaces, infections usually spread from the hand to the forearm.

A knowledge of these spaces and the location of injuries that usually lead to their involvement should be had to open properly and drain these most serious types of hand infections. To know the relations and boundaries of these various spaces is just as important as it is to know where to enter the abdomen for the appendix or to reach the gall-bladder. In other words, infections about the fingers and hand have too long been considered of rather minor importance and have been treated accordingly, whereas they must be recognized as very grave, serious conditions and must be studied and treated by the most approved surgical procedures, and every possible adjunct, both locally and constitutionally, must be employed to hasten recovery and prevent a spread of the infection.

A classification of the various types, as to location, of the 411 cases of hand infections which were serious enough to cause disability will give the relative frequency of the involvement of these different spaces.

I. The types of hand infections, named in their order of frequency, which were given ambulatory treatment.

a	Paronychia	90
b	Superficial or subepithelial abscesses	72
c	Abscesses in superficial connective-tissue spaces—cellulitis of hand	45
d	Carbuncular infections	20
e	Lymphangitis of arm from hand injury	13
f	Felons	10
g	Collar-button abscesses (distal edge of palm)	3
	Total	253

II. The types of hand infections, named in their order of frequency, which were given hospital treatment.

a	Lymphangitis of arm from hand injuries	59
b	Felons	24
c	Tenosynovitis	24
d	Abscesses in superficial connective-tissue spaces—cellulitis of hand	14
e	Collar-button abscesses	7
f	Carbuncular infections	5
g	Middle palmar space infections	5
h	Paronychia	3
i	Thenar space infections	3
	Hypothenar space infections	2
	Total	146

III. The twelve very serious cases where active treatment was adopted late were characterized by having more than one space involved, or some other form of complication, as follows:

a Diffuse cellulitis of hand and arm and general sepsis.
b Middle palmar space and ulnar bursa.
c Tenosynovitis and necrosis of bone of index finger.
d Tenosynovitis and multiple abscesses of arm.
e Diffuse cellulitis of hand and arm.
f Tenosynovitis, middle palmar abscess, and necrosis of bone.
g Thenar space, middle palmar space, and ulnar bursa (Fig. 5).
h Tenosynovitis and middle palmar space.
i Superficial abscess of hand, lymphangitis, and axillary abscess.
j Superficial abscess of hand, lymphangitis, axillary abscess, and subclavicular and subscapular abscess of chest-wall and general sepsis.
k Lymphangitis, axillary abscess, and subclavicular abscess of chest-wall.
l Lumbrical space abscess and necrosis of bone.

The operative procedure and the general and local treatment employed in these cases will be dealt with in a subsequent paper.

CONCLUSIONS

The treatment of hand infections, therefore, in order to give the best results from every viewpoint must include—

1. The proper preventive measures, especially the prophylactic use of tincture of iodine and the early reporting of all minor injuries.
2. The treatment of hand infections as a serious surgical condition from their inception, and whenever indicated the adoption of hospital treatment early.
3. The proper and early diagnosis of the type and nature of infection and the exact location of the pus.
4. A proper incision of the abscess in order to establish adequate drainage and yet not spread the infection to other spaces.

HYSTERICAL JOINT NEUROSES

With Especial Reference to the Hip; and Report of a Case Simulating Fracture of the Neck of the Femur

By CARL W. RAND, A.M., M.D., Chicago

HYSTERICAL manifestations are so myriad and varied that it would be unfitting to attempt a classification of them here. The purpose of this communication is simply to place emphasis on one of the more uncommon phases of hysteria: namely, joint neurosis, with especial reference to the hip.

Sir Benjamin C. Brodie (1) was perhaps the first to call attention to this subject in 1837. In his "Pathological and Surgical Observations on the Diseases of the Joints" he alludes to "neuralgia of the joints," implying by the term neuralgia "the fact that pain is referred to a part which is not the actual seat of the disease." Brodie considered that "neuralgia of the joints" might arise from different circumstances, regarding an "hysterical state or constitution" as by far the most frequent cause. He states that though men are not exempt, the condition is more commonly seen in women, "especially in young women of the more affluent class of society, living in hot rooms, taking little exercise in the open air, and of self-indulgent habits." He fully realized the difficulty of accurately separating these hysterical conditions from other forms of organically diseased joints, stating that he was sensible of having erred frequently in diagnosis. The French have been quick to recognize the importance of his observations, referring frequently to neuromimetic joint affections as "coxalgie hystérique," "maladie de Brodie," etc. Faitout (2) gives a scholarly general review under the title "La coxalgie hystérique."

Attention was later called to this subject by Robert, 1860 (3), Barwell, 1861 (4), Giraldès, 1865 (5), and in 1867 by Sir James Paget (6) in the *British Medical Journal* under the startling title "Cases that Bone-Setters Cure." Paget likewise was undoubtedly impressed by the teaching of his famous predecessor. He remarks: "An hysterical joint is, indeed, sometimes a rare opportunity for a bone-setter. Cold, weak, useless for want of power of will, intensely sensitive, subject to all the seeming caprices of a disorderly spinal cord and too vivid brain, such a joint as this may be cured by the sheer audacity with which it is pulled about — and so not only bone-setters, but the workers with mesmerism, and tinctures and oils, and distant or superficial electricity, can sometimes cure hysterical joints; for the patients love to be cured by a wonder, and the audacious confidence of all these conjurors is truly wonderful." Such warnings are unfortunately applicable even today.

Six years later, in his "Clinical Lectures and Essays," Paget (7) devotes several chapters to the subject of "nervous mimicry" in joints, alluding to the fact that the more or less acute inflammations are most often imitated and are perhaps most commonly confused. He concludes: "But, after all, the sign most to be relied on for diagnosis between real and nervous disease of joints is the temperature — a joint that is cold by day and hot by night is not an inflamed joint, that is certain."

It is not the object of this paper to enumerate the symptoms of joint diseases in general, nor does the discussion of the various metastatic arthritides, of the Charcot joints of tabes dorsalis, or of other organic neuropathic disturbances of joints lend itself here. These hysterical conditions are found in the same relative frequency among the joints most often the seat of organic disease. Various authors agree that the knee-joint is most often affected; the hip, wrist, shoulder, and ankle joints following in order of frequency. Paget states that any joint may be the seat of "nervous mimicry" after an injury, he having seen it "in the elbow, shoulder, cervical spine, hip, knee, and ankle." He considered the

Skiagram of right hip. Showing normal relations of the hip-joint and absence of fracture of the head, neck, or trochanter.

hip and knee most frequently affected, next "the tarsal and carpal joints, or the elbow and shoulder, but in these, mimicries are too rare for counting."

The onset may follow immediately upon an injury, though more frequently an "incubation period of 'psychic meditation'" (Barker, 8) may elapse before active symptoms appear. Neu (9) considers pain the most prominent feature, which is intensified by movement and apparently due to a hypersensitive condition of the skin simulating the joint area rather than to any direct changes in this structure itself. Fuchs (10) describes the pain as sudden, burning, and paroxysmal, and states that it may even lead to amputation or resection of the joint in question. Brodie (1) sums up the condition admirably: "The symptoms may frequently be traced to the circumstance of the patient's attention having been anxiously directed to a particular joint. Sometimes they have followed a blow or wrench, or some very trifling injury. . . . At first there is pain referred to the affected joint, of which the patient complains in different degrees, not only in different cases, but even in the same case at different periods. Often, if her thoughts are occupied by some other object of interest, she seems to forget the pains altogether, although there is no doubt that at another time she suffers severely. . . . The joint is tender, but the tenderness is peculiar also; a light touch, or even pinching of the skin, will often cause more pain than a firm and steady pressure, causing the patient to wince and even exciting motions very similar to those of chorea; another very characteristic symptom is that whatever the pain may be during the day it does not awaken her from sleep at night."

The difficulty in diagnosis is very real because the same factors may exist for the organic and for the imitated joint affections. The presence of pain, stiffness, contractures, local elevation of temperature and swelling, disuse, subsequent wasting of the extremity in question, and even systemic fever — any or all of which may occur in true joint disease — may also be present in hysterical joint neuroses. The injury may not seem adequate for the trouble that ensues, and a suspicion of neurommemesis should be entertained if pain sets in with full severity immediately after a trifling injury.

A simple but efficacious means of differentiating between true and feigned disease is offered by careful examination of the joint in question with the patient under surgical anæsthesia. When the patient is deeply anæsthetized, the joint may be found to move as freely as in health, but in an organically diseased joint the muscle spasm protects the movement of the joint before the patient has regained consciousness, while in the mimic disease no effort of protection is evidenced until full consciousness is restored. Charcot advised the use of chloroform as an aid in differential diagnosis on the basis that in psychoneurotic joints the skin tenderness returns first, while in those the seat of organic disease deep joint tenderness ensues. Today the aid of röntgenology should always be sought when there is any question of joint disease. In the case reported below, the diagnosis was readily established by skiagrams of the hip in question, carefully made at intervals.

Frequent allusions to pathological changes

present in these neuromimetic joints have been made, but no definite picture has been found constant. Brodie described a slight degree of swelling being sometimes perceptible when a joint had been for some time the seat of hysterical pain. This, however, he believed to be apparently due to "some effusion into the cells of the cellular texture external to it" rather than to changes in the joint itself. Mitchell (11) reported a case in 1885 of a girl, 16 years old, who presented marked hysterical features, the most striking of which was a contracture of the left knee, which had persisted for about three years. The knee became swollen, measuring one inch more in circumference than its fellow; it was red, shining, exquisitely tender. "It was certainly unlike a synovitis, and still more unlike articular osteitis, nor did it resemble anything known to the books." Billroth and Nothnagel considered it organically involved, the former suggesting that "fungus products" would be found in the joint. Prof. Henry Sands, of New York, subsequently operated, found the joint surfaces normal, and the enlargements entirely due to inflammatory infiltration of the fatty and connective tissues surrounding the capsule. This in a measure supported the observation made by Brodie many years previously. Mitchell concludes: "For those who believe that hysteria never gives rise to organic changes, this case will certainly be full of instruction." In neuromimetic joints of long duration, as in those organically diseased, muscle atrophy may exist. According to Gilles de la Tourette (12), this atrophy differs, being more general throughout the extremity with the psychoneurotic joint, while with the organically diseased joint it is localized chiefly to the adjacent muscle groups which act in moving the limb.

In reviewing the literature, so few (twenty-two) cases of hysterical affections of the hip-joint alone have been encountered that it may not be amiss to enumerate them here. Many cases of hysterical neurosis involving multiple joints are on record. Only those of the hip will be mentioned, and among them the reader will note with what great conformity an inflammatory condition is simulated. The conditions cited have usually, but not always, followed a trauma. The treatment consists largely of reëducation, application of cautery, generally helpful suggestion, hypnotism, carefully supervised extensions with gradually increasing exercise as the patient's confidence is gained, etc. The diagnosis has been confirmed in many instances by examination of the joint with the patient under surgical anæsthesia.

Case 1. Maere (13) in 1887 reported a case in a girl of 16, admitted to the clinic of Prof. Cock, presenting symptoms of hysterical contracture of the left hip, following a fall downstairs. There was an apparent shortening of 4 cm., abduction, and contractures. Under chloroform anæsthesia the joint was found to be normally mobile, and the patient left the hospital. Seven days later, following fatigue, the same symptoms returned. Contracture again disappeared during chloroform and returned on awakening. Hyperæsthesia on the right, anæsthesia on the left, and radiating pains ensued. Medication was of no avail and therefore was discontinued. She remained in this condition three weeks; then all of the symptoms suddenly disappeared, and she was again able to walk and even to run without difficulty.

Case 2. Peckham (14) in 1893 reported a case of "Hysterical Hip-joint Successfully Treated by Hypnotism." The patient, a girl of 18, fell in a woolen mill on July 5, 1892. She was rendered unconscious, and injured her right hip and right side of her head. She walked home and remained in bed two days. One month later the right hip became painful and tender and kept her awake nights. She was first seen in May, 1893, the case diagnosed as purely hysterical, and hypnotism resorted to as a therapeutic measure. After twelve séances the case was discharged as cured in August, 1893, practically fifteen months after her injury.

Case 3. Fort (15) in 1894 reports briefly two cases of hysterical joint neurosis, the first in a little girl, age not stated, in which the hip was affected. The condition presented symptoms similar to those seen in tuberculosis of the hip. There was no definite history of trauma preceding. The result is not stated. The second case was in a woman of twenty in which the knee was affected. Fort's report includes Agnew's tables of differential diagnosis between pseudo-arthritis and arthritis.

Hotz (16) in 1895 presented a comprehensive review of the subject in his monograph, "Zur Kenntniss der Gelenkneurosen, etc." In this contribution he reviews the literature and gives abstracts of cases of various joint neuroses. He cites Charcot as describing the first case of a hysterical joint in a man, and M. Glorieux, 1888, the second case in a soldier at the Academy of Medicine of Belgium. He does not state that either of these cases involved the hip-joint. The following eight cases of hip neuroses are taken from Hotz's monograph.

CASE 4. Observation of Dr. F. Esmarck: The patient, a girl of twenty, fell while crossing the street, in February, 1853. She struck her right knee against a lamp-post. The knee became swollen, although she walked all day. That night she was forced to ride home on account of pain. A prolonged course of treatment followed, under the direction of various physicians, principally Stromeyer of Kiel; ultimate recovery. Fifteen years later, March 1, 1868, Esmarck again saw the same patient, now a woman of 35. She was suffering from pain of a right hip-joint neurosis. No history of trauma; had been treated for coxitis; two months in bed. She had lost weight, spent sleepless nights, had hysterical vomiting, etc. Treatment in the form of reëducation was instituted; she was encouraged to walk out of doors, etc., and in a short time was able to walk without complaining of pain in her hip.

CASE 5. Brodie (i.e., page 415): Neurosis of hip-joint; healing through prayer. A woman who suffered a long time, being confined to bed with hysterical affections, was cured by the prayers of her father-confessor, so that she left her bed and walked, to the astonishment of her family.

CASE 6. Russ: A case of hip-joint neurosis in a boy of 17, in whom operative treatment had been advised but not consented to by the parents. Complete recovery followed one application of an iron cautery, so that the patient even attended the theater on the same night.

CASE 7. Russ (Ostrokakologie, page 142): Hip case with apparent lengthening of the legs; rapid healing after a single treatment of the cautery. Servant girl, age 23, fell twice on her buttocks, the second time on the left trochanter. Four months later the left hip "went lame." There was flexion, abduction, rotation outward. Four or five long streaks were made behind the trochanter with a cautery and two hours later she was apparently cured. "All pain was gone, and the patient jumped around the room one-half hour for joy."

CASE 8. Skey in 1864 (Hysteria, page 102) cites a case of hip-joint neurosis which orthopedic appliances failed to relieve, but which was cured by dancing. The patient was a 16-year-old girl who had twisted her foot inward eight months before. Complete recovery.

CASE 9. Marion-Sims (Klinik der Gebärmutter Chirurgie, page 216) cites a case of hysterial coxalgia accompanying obstructive endometritis. The patient was a sensitive, beautiful woman who had been married six years, and had borne no children. She became bedridden, a chronic invalid, complaining of excruciating pain in the left hip near the joint. A granular erosion of the cervix was successfully cured in two months, but the pain in the hip persisted. Upon further examination it was found that there was an atresia of the cervical canal. This was dilated and injected frequently with glycerin. She has had several children since, and the pain in the hip-joint has entirely disappeared.

Hotz states that one of his colleagues reports a similar case in which there was pain in the left hip-joint when the cervical canal was probed.

CASE 10. Benedikt (Eliktrotherapie, page 112, Beob, 5) reports a case of hip-joint neurosis in a woman of 30 who was treated with electrotherapy and heat applications without avail. She had suffered moderately nine years with hip pains, and for two years with violent coxitis. Other hysterical stigmata were present, such as globus hystericus, gastric cramps, hemicrania, sometimes left, sometimes right, weakness in her legs, leucorrhœa, and scanty menstruation, fleeting hot flashes, and cutaneous hyperæsthesia, etc. Pain was intense in both legs but particularly so in her left hip. Galvanism given for six months failed to give relieve.

CASE 11. Aman (Über den Einfluss der wieblichen geschlecht krankheiten auf die Hysterie, page 7) cites a case of neurosis of the hip-joint in a girl of 24, who was helped by galvanism and general symptomatic treatment. She suffered from dysmenorrhœa and frequent globus hystericus. There had been intervals of pain in the right hip since she was four years of age, paroxysmal, increased by movement, and often accompanied by swelling. For many days she could walk almost normally; then again was forced to go to bed on account of pain in her hip, which was so severe as to keep her awake nights. She gradually improved after a course of galvanism, reëducation, etc.

CASE 12. Morton (17) in 1896 describes a "Case of Hysterical Disease of Both Hips and Both Knees with Extreme Distortion of the Lower Limbs." For three years she was under treatment by various surgeons, but when the true nature of the affection was recognized she was cured in less than three months. The condition had been considered tuberculosis of the joints. The left hip was affected at the ages of 9, 12, and 19. When seen by Morton, the position of the limb was not possible with a normal hip. Manipulation was made under ether, with subsequent treatment by splints, extension, and walking. She was discharged January 23, 1897, well, with the exception of relaxation of the ligaments and slight adhesions in the knee-joints.

CASE 13. Carrier et Rainquet (18) in 1897 published a case of "coxalgie hystérique" in a boy of 17. In November, 1896, patient noticed pain about the sacrum and lumbar region, which disappeared when standing erect or lying down. He was treated for lumbago from January 28 to May 25, 1897, complaining of severe lightning pains in right lumbar region and hip. Pain seemed to follow the course of the psoas muscle and anterior surface of the right thigh and knee. The right thigh was adducted and flexed. There was apparent shortening. No contractures, œdema, or trophic disturbances. Absence of other hysterical stigmata, save sluggish pupillary, and absence of abdominal reflexes. The result of this case is not stated.

CASE 14. Branchi (19) in 1898 reports a case in an eleven-year-old girl who, after a fall on the hip,

showed symptoms resembling tuberculous coxitis. Complete recovery followed a course of "energetic suggestion."

CASE 15. Lannois (20) in 1899 describes a case of "coxalgie hystérique" in a girl of 20. In August, 1898, she was trampled on by a cow. Following this the left hip became painful and stiff. There was marked adduction and apparent shortening. On October 22, 1898, the hip was manipulated under chloroform anæsthesia and motion found to be perfectly free. Lannois regretted that no röntgenogram was possible, as it would save many similar cases from subsequent surgical and unnecessary medical treatment. Ultimate recovery.

CASE 16. Porter (21) in 1900 cites a case of hysterical hip-joint in a school girl, age 11, of gradual onset. There was fixation, flexion, pain, and atrophy of the muscles surrounding the joint. Complete relaxation of the joint evidenced in sleep. Flexion corrected by a cast. Patient treated from September, 1897, to April, 1899, at which time the contractures still persisted, though in a less marked degree than when first seen.

Dumon and Ronslacroix (22) in 1900 cite two cases of hysterical hip-joint.

CASE 17. A girl of 17, first seen July 12, 1900, had complained for two months previously of pain in the left hip, knee, and tibiotarsal articulations, with inability to walk. Examination revealed adduction, internal rotation, and hyperextension of the left leg. Pressure on foot caused no pain; pressure at knee and condyles caused pain. Pain very violent in left hip, where deep palpation caused dull ache. No hyperæsthesia, apparent shortening, marked claudication and dorsolumbar scoliosis (compensatory). Patient subject to frequent periods of unconsciousness and *petite mal*. Treated by suggestion, hypnotism, etc., from September 4 to October 8, 1900, when she could walk without limping.

CASE 18. A seamstress, age 18, first seen August 10, 1900. The causes for admission to the hospital were twofold: (a) complete aphonia; (b) pain in the left leg, most augmented in the coxofemoral articulation. There was flexion, adduction, internal rotation, apparent shortening; no claudication, œdema, redness, or enlargement of collateral venous circulation. The pain was most acute in the left groin and trochanter, also in the knee and tarsotibial articulation to a less marked degree. "Le signe de Brodie," i.e., cutaneous hyperæsthesia with articular analgesia, was not present. The hip was manipulated under chloroform anæsthesia on September 25, 1900, and no organic lesion found. On October 8, 1900, the patient could talk in a whisper, and during her two and one-half months' stay in the hospital the hip gradually became less painful. Daily exercise resorted to; ultimate result not stated. The authors refer to articles by Plique (23) and Huet (24), the latter of whom reports a case of "coxalgie hystérique" in which Brodie's sign was not observed.

CASE 19. De Britto (25) in 1905 reports a case of hysterical hip combined with double blepharospasm. Patient, child of 11 years, who at 4 years and 5 months had an infection of the hip, which was incised and pus escaped. Recovery complete. On admission May 8, 1905, to Hospital de Caridate de Parto Alegre, etc., the patient was suffering from double blepharospasm with complete entropion of the lower lids. The right leg was flexed, adducted atrophied, and painful at the hip. There was definite hyperæsthesia and contracture. Under chloroform anæsthesia there was found to be perfect articular mobility of the joint in question. Treatment, suggestion, reëducation, etc., with marked improvement.

CASE 20. Callewaert (26) in 1907 quotes a case of local hysteria following injury of the hip. The patient, a mason of 36, fell seven meters on June 11, 1906. He was rendered unconscious and received a luxation of the right hip which was easily reduced before he awoke. He received slight head injuries. On waking, the right leg assumed an abnormal position and the patient could not move it. It presented a picture "as if the luxation had been reproduced." In October, 1906, the right leg was still abducted, externally rotated, and apparently four centimeters short. All movements were possible but impaired. Under chloroform anæsthesia, the hip-joint was freely movable and could be placed in a normal position. The contraction and malposition returned after consciousness was regained. Röntgen ray revealed asymmetry only, resulting from the vicious position of the femur and buttocks. By December 1906, the patient had become thin. He was deeply chagrined at his incapacity. The abdominal reflexes were gone and marked dermatographia existed. Pharyngeal and corneal reflexes were absent. The visual fields were contracted for white and blue, normal for red and green. The knee-jerk was exaggerated on the right. The result is not given, but the author states that the condition resembled a tuberculosis of the affected hip. He concludes that in such cases of hysterical joint neuroses "there may be no history of injury," and that the patient "may drag his foot all through life."

Eymeri (27) in 1912 reports two cases of "coxalgie hystérique." He quotes Folly that this condition "is one of the most complex pathology; complex in diagnosis, treatment, and evolution; complex also in point of view of medicolegal solution."

CASE 21. A soldier, first seen July 29, 1911. The patient fell downstairs January 18, 1911, injuring the right hip; unable to rise; only slight contusion sustained. He remained in bed for one month, then began to walk with a cane. Three

months later the symptoms of pain in the right hip returned. Röntgenograms of hip negative. There was slight hypoæsthesia of the right thigh. Other hysterical stigmata present were (a) contracted visual fields; (b) slight goiter; (c) superficial reflexes absent, deep present; (d) inability to move right leg voluntarily. Treatment consisted of suggestion and electricity. Well in two months.

CASE 22. Soldier treated for "hystérique mâle avec psycho-asthenio." Typhoid at 9, followed by dyspepsia and general inanition; adolescence delicate. On March 20, 1911, the patient fell downstairs and fractured clavicle. Home in one month. Forty-four days after accident suddenly suffered with gastric crisis, vomiting, claudication and paræsthesia of the legs, and pain in right hip. Physical examination negative except for absence of plantar reflexes, and deep reflexes increased in right leg. Diagnosis of "coxalgie hystérique" made. Treatment, suggestion, electricity, reëducation. At time of report no improvement. Eymeri suggests it will be interesting to note the result at the end of one year.

The history of the case observed by the author is as follows:

On January 6, 1915, Miss X., age 24, single, clerk in public school work, was brought to Mercy Hospital on a stretcher as an emergency case. About an hour previously while walking to school she had fallen on the icy pavement, striking on her right hip. She complained immediately of excruciating pain in this hip and made no effort to rise. Upon being brought to the hospital she was taken directly to the amphitheater before an operating clinic, where an examination was conducted. A tentative diagnosis of fracture of the neck of the femur was made, and a discussion on this subject, using the patient as an example, followed in her hearing.

The principal points brought out by examination at this time were: slight apparent shortening and external rotation of the right limb, exquisite tenderness on slightest pressure over the great trochanter, marked muscle spasm about the joint, and great pain when passive motion was attempted. There was no ecchymosis, no swelling about the hip, no crepitus. The trochanter was well below Bryant's line. All classic signs of inflammation were absent. Nevertheless, the complete disability coupled with such extreme pain seemed to indicate that the neck of the femur was fractured or the head had been luxated.

The patient was put to bed, a Buck's extension of twenty pounds was applied to the right limb, and both legs were placed in a double abduction splint in the usual way. Skiagraphs taken the second day proved negative for fracture or dislocation (see skiagram). Careful measurement showed no actual shortening. There was no atrophy. For several days the patient complained of excruciating hip pains in spite of the extension, and more skiagrams of both hip and entire femur were taken at different angles, but disclosed no pathological condition of either joint, neck, or shaft of the femur.

Physical examination was essentially negative save for the presence of an old laparotomy scar below the umbilicus. Investigation of its cause led to interesting data. In 1909, when 19 years of age, the patient had fallen to the floor while playing basket-ball. She suffered no severe immediate injury, but her next menstrual period was exceedingly painful. For four years previous to this, catamenia had been normal in every respect. During the years 1910 and 1911 she suffered great pain during her periods and stated that at times she would lie unconscious during the first day of her flow. In May, 1911, she was operated upon, the round ligaments shortened (?) and appendix removed. This entirely relieved her dysmenorrhœa and since 1911 her periods have been regular, 28-day type, the flow lasting two to three days. She attributes all of this menstrual disturbance to the fall in 1909.

On the evening of January 20, 1915, two weeks after admission, she became emotional and soon presented unmistakable manifestations of hysteria. She assumed attitudes of prayer with her hands, presented marked opisthotonos, rolled her eyes up, trembled, complained of difficulty in swallowing and breathing (globus hystericus), and threw herself about in bed quite regardless of her injured hip. A diagnosis of joint neurosis of hysterical type was made. The next day, after the patient had become herself again, the skiagrams were shown her and their negative findings explained in great detail.

She was told emphatically that she had not broken her hip, and it was suggested by her physician that she could walk even then. She assented to a trial, the extension was removed, and she was assisted to her feet. Although quite emotional, she took a few steps unaided about the room. The next day she was allowed up about the room, and on January 22, 1915, sixteen days after her fall, she walked from the hospital without a limp.

This case is interesting because of the sequence of events which helped to establish the diagnosis. Undoubtedly the girl had suffered from hysterical phenomena previously. Her mother stated that she had always been secretive and different from her brothers and sisters in that she was more shy and nervous. It would seem that the disturbances of catamenia were hysterical; certainly she attributed them to a fall in 1909 and presented spells resembling coma during the first day of each period until her operation in 1911.

In the present instance she was again subjected to sudden trauma, falling on her right hip. The obsession of some severe

injury possessed her. She was unfortunately examined before a large body of doctors, where a diagnosis of fracture of the neck of the femur was made, and its symptoms, prognosis, and treatment, discussed. Only after repeated negative röntgen-ray examinations and the stormy manifestations of her hysterical attack was the condition of true joint neurosis established. The fact that function returned as soon as the patient's confidence was gained supported this diagnosis.

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CARCINOMA OF THE RECTUM[1]

By L. L. McARTHUR, M.D., F.A.C.S., Chicago

CARCINOMA of the rectum, considered surgically, has as the result of experience been found to be amenable to no one method, route, or procedure. This has developed naturally, as the many factors which enter into the given case have had to be met and overcome.

With the growth situated at the anal outlet the line of attack is naturally from below. If in the female, it is anteriorly, as first recommended by the writer in 1887 in his thesis for admission to the Chicago Gynecological Society, and since endorsed by Murphy, Witzel, *et al.* The growth can be removed by a temporary median reflexion of the posterior vaginal wall. In the event of the wall and the perineum in its lower two-thirds being involved, or the growth invading so much of the rectum as to render it impossible to bring the proximal end to the perineal incision, the author demonstrated an instance of successful implantation of the proximal end of the rectum into the posterior vaginal cul-de-sac, after total extirpation of the rectum and

[1] Read before the Chicago Surgical Society, April 2, 1915. (See p. 536 for discussion.)

anus, with satisfactory control to the patient when no diarrhœa existed. If in the male the posterior median incision, with removal of the coccyx and part of the sacrum, when necessary, will be the operation of choice.

When, however, the carcinoma is one of the higher-lying variety, palpable to the finger, but its extent not to be thus determined, an entirely different proposition then obtains. Here opinion is divided as to whether one of the extensive Kraske operations should be made, or whether the attack should be through the abdomen, or a combination of the two be utilized. When invited by your president to take part in the symposium planned for this evening, it was to this particular type I promised to respond, and that with special reference to the technique of construction of a permanent more or less satisfactory anus præternaturalis.

Personally, my experience has convinced me that in the majority of such cases the safety of the patient is best conserved by a two-stage operation; in the small minority the work can be done at one sitting. Final determination as to the procedure of choice should only then be made, when the abdomen has been opened by a median suprapubic incision sufficiently large to permit a free palpation of the entire abdomen and pelvis, for then only can one be reasonably justified in subjecting a patient to a procedure that among the best of operators has a mortality between 10 and 15 per cent, and permanency of cure of half its mortality. With the abdomen open, the first search should be for metastases, in the retroperitoneal glands and omentum, since here the lymph-channels lie; in the liver, since the portal circulation alone of all the venous systems seems to transport the infective elements of cancer; in the neighboring pelvic organs, since both by direct invasion, and by contact implantation, they may become involved. In the event of inoperable metastases no attempt at removal of the rectal carcinoma should be considered and the decision then be made between a permanent or temporary anus — permanent, if there remains no chance of an anastomosis above and below the obstruction, as can sometimes be done with the small circular carcinoma; temporary if, after an existing or recent ileus, there seems to be reasonable hope of relief later by major surgery, the intestinal toxæmia having been relieved. Since the major part of these high-lying carcinomata coming to me were suffering with an acute or chronic ileus, I have been more frequently compelled to pause with the simple relief of their obstructive symptoms; when I have attempted more I have often regretted it. That this is so, is due to the fact that the first emphatic symptom compelling attention is to the diminished lumen of the gut. Should the obstructive symptoms be overcome and the diagnosis be made prior to the opening of the abdomen, it may sometimes be feasible to have the patient in fit condition for the radical operation at the first sitting. However, inasmuch as a successful circular suture of the rectum is the exception (particularly so if the fæcal flow is immediately established) I incline strongly to establishing *temporary* inguinal colostomy in those cases in which resection with circular suture is contemplated. In those cases in which circular suture does not seem feasible then the establishment of a permanent inguinal colostomy, after section of the bowel as *low down* as is consistent with inversion of the distal end, the latter being loosened laterally and posteriorly, then pushed low on the sacrum. This should then be covered with as much peritoneum as possible, some of the gap being filled in by the sigmoid loop, properly named by Jonnesco the pelvic colon, and the abdomen closed. Two to four weeks after the establishment of the new anus, the growth can be removed by the sacral route, without fear of the establishment of a fæcal fistula or the fatal sepsis that too often attends the failure to divert the fæcal stream.

I am heartily in accord with the Mayos, both of whom believe the patient's desire for a sacral or perineal anus is one of sentiment, and not borne out in practice as best; for the incontinent anus here can never be as well controlled, cleaned, or cared for as can the properly constructed left inguinal colostomy. This group does not include those *few* cases in which the anal and internal sphincters with an inch or more of bowel being unin-

vaded, can be preserved for junction in one of many ways with the mobilized rectosigmoid. I say *few*, because many disappointments as to competency have been observed after the most perfect junctions of this type have been obtained surgically. It is now conceded that the rectosigmoid loop is the natural receptacle for the fæces prior to escape. Since this loop cannot act as a storehouse when straightened and stretched down to the perineum, the sacral anus is more often incompetent than the inguinal.

When presenting, in May, 1894,[1] my recommendation of the muscle-splitting incision I called attention to the many situations in which this procedure might be utilized and began early to adapt it to the inguinal anus. Bailey improved the procedure by channeling beneath the skin for an inch or more to the left and suturing the gut to the margin of a second skin incision. To Senn I am inclined to give the credit for the suggestion that this incision should lie to the outer side of the line between the anterior superior and anterior inferior spines, since here we have a bony background against which pressure can be made for control of the fæcal escape. Moreover, at this level, a low-lying belt girdling the pelvis remains in place, slipping neither up nor down, beneath which the pad can be placed which shall control the new anus.

[1] Chicago Med. Rec., 1894 November.

MORTALITY AND PROGNOSIS IN OPERATIVE TREATMENT OF CANCER OF THE RECTUM[1]

By CARL B. DAVIS, M.D., F.A.C.S., Chicago

THE results of operative treatment of cancer of the rectum vary with the location of the growth and with the type of operation. Under results we must consider immediate mortality, recurrence, and sphincter control or its best substitute. The judging of any particular procedure on the basis of one of these factors has led to the great diversity of opinion among surgeons. The indications for this or that operative method have not been worked out to a commonly accepted technique; one surgeon feeling that a posterior operation with low mortality and great probability of recurrence is preferable to an abdominal operation with a higher immediate mortality and smaller probability of recurrence.

Some operators favor a technique that demands a termination of the bowel on the abdominal wall, where other surgeons, chief among whom is Hochenegg, make every effort to bring the bowel down to some form of posterior termination. The great variation in the mortality rate of the combined operation is due to several important factors. Some operators do the abdominal step only as a secondary makeshift in cases where they have found it impossible to remove all the disease after starting with the Kraske or sacral route. In such cases infection is carried from the sacral wound soiled by the escape of fæces, to the abdominal cavity. Where the abdominal work is done first, designedly, the danger of sepsis is avoided. Again, cases that are desperate risks — inoperable by the sacral route — are attempted by the combined route, and when lost are charged against the method. Statistics of the past were created by men who were trained in the old technique and would not use the combined operation where there was any possibility of employing some posterior operation.

In a rough way operative treatment is divided into two groups: one for disease low in the rectum, and a second for disease high in the rectum. Some form of posterior operation is commonly used where a tumor lies so low in the bowel that its upper border is palpated by the examining finger. Mayo advises, however, where the ampulla of the

[1] Read before the Chicago Surgical Society, April 2, 1915. (See p. 536 for discussion.)

rectum is involved that it is better to remove the entire rectum because of recurrence. According to statistics from several clinics we find the perineal route shows a mortality varying from 5 to 12 per cent. Where the upper margin of the tumor lies above the tip of the examining finger, either a Kraske operation with 12 per cent to 18 per cent mortality or a combined abdominoperineal operation is used with an immediate mortality of 18 to 24 per cent, according to various authors. Terminating the bowel on the abdomen has shown a great reduction in the mortality rate. Interference with the blood supply in the endeavor to loosen and bring down the sigmoid colon to a sacral or perineal anus has been the cause of a high mortality from gangrene of the stump with secondary peritonitis. The higher the growth the more difficult it is to bring down sufficient sigmoid for the posterior anus. The surgeon realizing the difficulty has resorted to the combined operation and freed the bowel through the abdominal incision and then terminated the procedure with a posterior anus. If with the abdominal procedure in high rectal disease the bowel is always brought through the abdominal wall to an inguinal anus the mortality rate will surely fall. This has actually occurred in the statistics. Abdominal perineal one-stage operation showed a mortality of 35 per cent while those cases operated upon with a preliminary colostomy showed a mortality of 13 per cent. This last percentage is as low as the work of Hochenegg, who is the great advocate of the posterior operation. The immediate mortality of the two-stage combined operation shows an increase of only 5 or 6 points as compared with the average of all the posterior operations.

Recurrence has been very high in the literature. There is no effort in many of the larger statistics to distinguish between recurrence in the posterior operations and in the combined operation. Many authors remark on the small number of recurrences with the posterior ratio, but fail to give their figures. Hartmann, of Paris, in a compilation of cases from the French, English, German, and American literature, finds a mortality of 37 per cent for the combined operation, and a mortality of 15 per cent for the posterior operation. The recurrences in the cases operated upon by the combined operation he found to be 18 per cent while the recurrences in the posterior operation were 68 per cent. Thus 37 per cent mortality plus 18 per cent recurrence gives 55 per cent dying from cancer when handled by the combined technique against 15 per cent immediate mortality plus 68 per cent recurrence or 83 per cent dying from cancer when operated by a posterior operation.

Function following operation is an important element to the patient. Preservation of sphincter control is ideal but can be obtained only in the low-lying cases, as a rule. When the decision is left to the patient, there is always a demand that if a normal anus is unattainable then a termination of the bowel be obtained as near to the normal site as possible. The suggestion of an abdominal anus is repugnant. This decision should not be left entirely to the impression of the patient. With an abdominal anus we may promise better cleanliness because the field is controlled by aid of the sight and not the sense of touch alone, and with a properly constructed abdominal termination there is in many cases almost ideal control by means of apparatus.

END-RESULTS OF A SERIES OF THREE HUNDRED OPERATIONS ON THE GALL-BLADDER [1]

By J. J. BUCHANAN, M.D., F.A.C.S., Pittsburgh

THE three hundred operative cases of gall-bladder disease which I shall consider in this paper are consecutive, and comprise all such cases as are not too recent to be properly included.[1]

The present inquiry into the subsequent history of my gall-bladder patients was prompted by a growing feeling of dissatisfaction and uncertainty as to the ultimate outcome of the drainage operations which I have so generally practiced. This feeling arose from the return of an occasional patient who proved not to have been cured, and, what was still more disquieting, the information that a few others had been operated on a second time elsewhere.

About a year ago I instituted an investigation to find out, for my own instruction, just what results I had been getting for years back; and at the same time I watched the literature for end-results reported by others in similar series of cases, noting also the practice and opinions of surgeons of large experience.

Starting, where we must all start, at the Mayo Clinic, I find that at St. Mary's Hospital, during the year 1914, of a total of 849 cases of operation on the gall-bladder alone, 708 were excised — 83⅓ per cent — and that all of the 140 cases that were drained were cases of acute cholecystitis, with or without stone.

This very radical practice was foreshadowed by the paper of W. J. Mayo in the *American Journal of the Medical Sciences*, April, 1914. He there stated that while cholecystotomy may be an efficient procedure in gall-stone disease when the gall-bladder is otherwise normal and the ducts are free, in cholecystitis the method is not satisfactory. A gall-bladder which can keep up continuous trouble from infection alone, without the mechanical irritation of gall-stones, will probably not be cured by simple drainage, and cholecystectomy will be the procedure to follow. "As a matter of fact," he says, "cholecystectomy is now largely indicated in gall-stone disease, and it may be said that practically *all* cases of cholecystitis and the *large majority* (probably 80 per cent) of cases of gall-stone disease should be treated by cholecystectomy rather than cholecystotomy."

John B. Deaver, in a paper read two years ago at a meeting of the Springfield Massachusetts Academy of Medicine, said: "The subject of cholecystectomy is not one to be lightly considered or easily decided. My own experience with these operations, their relative mortality and curative effects, inclines me to be rather more radical than hitherto. I would still counsel the inexperienced surgeon to cling to cholecystostomy. . . . I have, however, had enough disappointments with cholecystostomy to believe that there are cases in which I should remove the gall-bladder, provided only that I am able to select them at the time of operation. . . . In most cases of acute calculus cholecystitis, I remove the gall-bladder. . . . I do not remove gall-bladders simply for old chronic changes unless the organ is practically destroyed and valueless or dangerous in appearance from the standpoint of malignancy. . . . Temporary improvement is the rule after cholecystostomy. Permanent cure results in the majority of cases; but in the chronic infection carriers, cholecystectomy is more reliable from the standpoint of the ultimate result. . . . The removal of the gall-bladder may be a matter of extreme simplicity or of the greatest difficulty. . . . As a rule, the stronger the indications for cholecystectomy the greater the operative difficulty."

George W. Crile, in a paper published in *Surgery, Gynecology and Obstetrics* in April, 1914, stated: "No adverse effects from cholecystectomy have been seen, provided

[1] Credit and thanks are due to the writer's assistant, Dr. N. P. Davis, for efficient aid in abstracting these cases.

[1] Read before the American Surgical Association, Rochester, Minnesota, June 10, 1915.

the division is made at the beginning of the cystic duct, that no gall-bladder is left, and that the division does not at all encroach on the common duct. . . . If acute infection be present, then, in most cases, cholecystostomy should be first performed, followed, if required, by a later cholecystectomy. If the gall-bladder and the cystic duct be approximately normal, then the gall-bladder should be left. If the gall-bladder be thick, contain much scar-tissue, be shrunken, show chronic infection of the wall; if the cystic duct be partially or completely strictured; or if a stone be impacted in the duct, then cholecystectomy should be performed."

It will be noticed that the practice of these three operators differs widely in their choice of operation, and this is typical of the wide range of opinion on this subject. Contrary to what is generally believed and taught, I think the gall-bladder has remarkable powers of recuperation. As I look over the records of my cases and observe the ravages of stone, of acute and chronic inflammation, including empyema of all grades and the cases of seeming gangrene of the mucosa, and follow the history of these same patients for years afterward, I am amazed at the resources of nature.

I believe that the fate of the drained gall-bladder that is not totally gangrenous (and totally gangrenous cases are exceedingly rare) lies in the perviousness of the cystic duct. If it is obstructed by an overlooked stone, or by a pressure-necrosis stricture from a previously impacted stone, then that patient stands a poor chance of a cure by drainage only. I believe that no operator can always know the condition of the cystic duct. If the bile flows freely through it during the operation, the probability is great in stone cases and acute inflammations that the gall-bladder will be restored to its function, whatever that is.

If the bile does not flow and a probe, as is usual, cannot be carried into the common duct, no one can tell whether this is due to a small overlooked stone, an organic stricture, or, what is most common, congestion of the mucous and submucous coats of a tortuous duct.

If any surgeon feels that he must make sure of every case, then he must remove every gall-bladder, and unless he be possessed of rare skill I believe his immediate mortality from cholecystectomy will far outbalance the morbidity of his uncured cases.

The worst that is likely to happen is that the patient is not cured and that he must be reoperated upon for the removal of a hopelessly crippled organ that is permanently out of commission. This is not pleasant, I will admit, either for the patient or the surgeon; but we must remember that it is not a common occurrence, and becomes more rare as the surgeon's skill increases.

The increase in risk of a secondary over a primary cholecystectomy seems to me to have been too greatly emphasized by many surgeons. I think they have been comparing different kinds of cases — the primary cholecystectomy in simple cases and the secondary cholecystectomy in difficult cases — cases in which a cholecystectomy would have been most dangerous as a primary operation and which as a secondary operation are difficult, not because the gall-bladder has been drained, but because it and the contiguous structures have been subjected to such violent pathological changes before the first operation was performed.

I am, therefore, disposed to think with Crile that in the severe, acute infections, the gall-bladder should be primarily drained, and in the cases not thus cured it should be subsequently removed. I believe this to be the practice also at the Mayo Clinic, where last year 140 cases of acute cholecystitis were drained, out of a total of 849 gall-bladder cases.

I have included in the list of cases considered in this paper all those in which the gall-bladder alone was involved in the disease, and also those in which the gall-bladder only seemed to be involved, but subsequent events proved that an overlooked stone existed in the common duct. I have included the acute cases of cholecystitis with or without stone comprising 32 per cent of the entire number, taking in the cases of empyema of the gall-bladder, of which there were 55, and the cases of total gangrene, of which there were

but 2. I have included also the chronic cases of cholecystitis without stone and the chronic cases of stone in the gall-bladder, whether or not the gall-bladder was evidently diseased. I call attention to the large proportion of acute cases.

I have omitted from the list the cases in which I have operated secondarily, the primary operation having been done elsewhere. I have also omitted the cases in which stone was found in the common duct at time of operation.

As to the conditions present in my cases of cholecystitis, whether or not caused or complicated by stone, I would say that I have regarded a case as acute if the gall-bladder presented the usual appearance of acute inflammation; namely, redness and thickening, with perhaps sponginess and friability.

I have applied to the quiet cases an equally simple test, such as we are accustomed to apply to the appendix; namely, that they should be considered cases of chronic inflammation only if they were thick, white, fibroid, atrophied, adherent, strictured, or hour-glass. In the chronic cases that require microscopical proof and the strawberry gall-bladder, my experience has been too limited to be of any value. Perhaps some of the cases which do not appear in my records as gall-bladder cases at all, in which I have examined the gall-bladder and considered it normal, may really have been of this type and should have been subjected to cholecystectomy. I do not know. I have no knowledge that any of these cases subsequently developed stones or were proved by operation to be pathological.

Of the 300 cases recorded in this paper, all have been traced but 18, giving 94 per cent of known results.[1] Many patients have been examined; many have replied by letter; and many have been reported on by their family physicians or by other medical men in the same town when the original attendant had died or moved away.

Without the kind assistance of these confreres no such approach to completeness of knowledge could have been attained.

[1] To the industry and perseverance of the writer's secretary, Miss N. M. Crider, is due the success in locating such a large proportion of these patients.

The cases that are designated as "satisfactorily cured" are such as appear, by the most careful scrutiny of the information secured, to have been completely relieved of symptoms referable to the bile tract. Those stated in the tables to have had unsatisfactory features in their subsequent history (12 per cent of the total number of cures) are set down in detail in a separate table. The uncured cases also are fully exploited in a table of their own.

The immediate and late results of the cases in this series are given in the following tables:

CHRONIC GALL-BLADDERS CONTAINING STONE, TREATED BY DRAINAGE

Cured satisfactorily	99	
Cured, but with some unsatisfactory features	16	115
Not cured		13
Not traced		10
Died		5
		143

	Per cent
Cured in the traced cases	86.5
Not cured in the traced cases	9.8
Died	3.5

CASES OF ACUTE CHOLECYSTITIS AND EMPYEMA WITH STONE TREATED BY DRAINAGE

Cured satisfactorily	42	
Cured, but with some unsatisfactory features	8	50
Not cured		14
Not traced		3
Died		6
		73

	Per cent
Cured in the traced cases	71.4
Not cured in the traced cases	20.
Died	8.3

GALL-BLADDERS CONTAINING STONE TREATED BY EXCISION

Cured satisfactorily	9
Not cured	1
	10

CHRONIC CASES OF CHOLECYSTITIS WITHOUT STONES TREATED BY DRAINAGE

Cured satisfactorily	38	
Cured, but with some unsatisfactory features	4	42
Not cured		4
Not traced		2
Died		1
		49

	Per cent
Cured in the traced cases	89.4
Not cured in the traced cases	8.5
Died	2.

ACUTE CASES OF CHOLECYSTITIS AND EMPYEMA WITHOUT STONES TREATED BY DRAINAGE

Cured satisfactorily	12
Not cured	4
Not traced	3
Died	2
	21

	Per cent
Cured in the traced cases	66.6
Not cured in the traced cases	22.2
Died	9.5

CASES OF CHOLECYSTITIS TREATED BY EXCISION

Cured	4

SUMMARY

Total number of cases	300
Died	14
General mortality, per cent	4.66

GALL-STONE CASES CONSIDERED CURED BUT WITH UNSATISFACTORY FEATURES

Slight, persisting, indefinite pains, 4 cases.
Indefinite abdominal pains which have ceased, 2 cases.
Severe abdominal pain attributable to other cause, 1 case.
Persistent pains of an ephemeral nature, 1 case.
Pains in region of gall-bladder for a time, but later well, 2 cases.
One severe attack, but perfectly well for last 15 years, 1 case.
Conflicting reports about pain after operation. Well now several years, 1 case.
Persistent slight drawing sensations, 2 cases.
Drawing sensations which have ceased, 1 case.
Dyspeptic symptoms, 1 case.
Delay in closure of fistula, 3 cases.
Prolonged drainage from common duct after cholecystectomy followed by spontaneous closure, 1 case.
Spontaneous passage of gall-stones from fistula after return home, 1 case.
Hernia, 3 cases.

CHOLECYSTITIS CASES CONSIDERED CURED BUT WITH UNSATISFACTORY FEATURES

No attacks, but considerable pain for first year. Well for last six years, 1 case.
Occasional pains for a time beginning at splenic flexure. Quite well now, 1 case.
Slight pains persist; no severe pains such as existed before operation, 2 cases.

CHRONIC GALL-STONE CASES NOT CURED BY DRAINAGE

CASE 1. Woman, age 69, operated upon in 1905. Cholecystectomy was performed six weeks later by a surgeon in a neighboring town, who found a single stone, probably impacted in the duct. She remained well thereafter. Primary cholecystectomy would almost certainly have cured this patient.

CASE 2. Man, age 40, operated upon in 1909. The gall-bladder was opened about three years later by another surgeon and 6 or 8 good sized stones removed. The gall-bladder was drained at this second operation. The subsequent history is not positively known. Primary cholecystectomy would probably have cured him.

CASE 3. Woman, age 23, operated upon in 1897. Returned four months later with persistent sinus. Fragments of stone were removed with a scoop and she is believed to have been cured, but cannot now be traced. Primary cholecystectomy would almost certainly have cured her.

CASE 4. Woman, age 33, operated upon in 1903. Persistent sinus known to have been present 21 months later. Patient then passed from observation. Primary cholecystectomy would almost certainly have cured her.

CASE 5. Woman, age 54, operated upon in 1909. Colics persisted for two years. She has been perfectly well for the last four years. Cholecystectomy would perhaps have cured her.

CASE 6. Woman, age 52, operated upon in 1914. Returned two and a half months after her drainage operation with a thickened gall-bladder without stone. Secondary cholecystectomy was performed. Her subsequent history could not be traced. Primary cholecystectomy would have obviated the necessity for a secondary operation.

CASE 7. Woman age 28, operated upon in 1908. Had repeated attacks of colic for next two years and her subsequent history is unknown. Cholecystectomy would probably have cured her.

CASE 8. Fat, flabby and jaundiced man, age 47, operated in 1909. Common duct thickened and enlarged, but no stones to be found in it. Stones in gall-bladder and cystic duct. Fistula reopened several times, opening preceded by pain. Patient has been well for the last year. Cholecystectomy would probably have prevented his subsequent attacks.

CASE 9. Woman operated upon in 1909. Remained well for a year, and had four slight attacks in the next five years. Cholecystectomy might have been a better operation in this case.

CASE 10. Woman, age 27, operated upon in 1909. Gall-bladder drained for empyema one year later and again four months afterward. Patient has been well for four and a half years. Cholecystectomy would have been a better operation.

CASE 11. Woman, age 36, operated upon in 1906. Cholecystectomy performed two months later and a single stone found impacted in the cystic duct. One year afterward this patient was operated upon in another hospital for adhesions and she is now in a third hospital said to be suffering with the same condition. Secondary cholecystectomy did not cure this patient.

CASE 12. Man operated upon in 1908. Remained well three and a half years and died of contracted kidney a year later. The only reason for entering him in the uncured list is that his physician's diagnosis was cirrhosis of the liver. Cholecystectomy would not have prevented his later illness.

CASE 13. Woman, age 50, operated upon in 1905. The patient had been seriously ill for two years and in that time had lost 113 pounds (weight on admission 87 pounds), and for a year had had a diarrhœa with four to ten stools a day. She died a month after discharge from the hospital. Cholecystectomy could not possibly have made any

change in this case, as her operation was merely an incident in the course of a fatal disease.

ACUTE GALL-STONE CASES NOT CURED BY DRAINAGE

CASE 1. Woman, age 69, operated upon in 1912. Empyema with one impacted stone. *Several attacks* in next few years, but now seems to be well.

CASE 2. Woman, age 56, operated upon in 1907. Empyema with many stones. *Delayed closure* of sinus. Five years later, *sinus reopened* and drained for a few weeks. Had three attacks last year, but is now well.

CASE 3. Woman, age 33, operated upon in April 1914. Empyema with three stones. Sinus did not permanently close for six months, by reason of *two overlooked impacted stones*, which were then removed by means of sponge tent and scoop. Patient has since remained well.

CASE 4. Woman, age 39, operated upon in 1909. Empyema with one stone. Well for six or eight months. Then some *cramp* in region of gall-bladder and a *hernia* developed.

CASE 5. Woman, age 36, operated upon in 1911. Complaints three and a half years later so indefinite it is impossible to say whether gall-bladder is at fault.

CASE 6. Man, age 60, operated upon in 1910. Empyema with stones. One stone in cystic duct had to be abandoned. Gall-bladder opened in another hospital for empyema in 1912. Recently examined and *still has some discomfort.*

CASE 7. Man, age 46, operated upon in 1911. Gall-bladder apparently gangrenous. Operation had to be completed rapidly. Stones picked from sinus later. *Reoperated upon for adhesions two and a half years later.* No more attacks, but some stomach symptoms.

CASE 8. Woman, age 59, operated upon in 1910. Empyema with stones. Stones scooped out two months later. Three years later *drained under local anæsthesia for chronic pancreatitis. Diabetic.*

CASE 9. Woman, age 40, operated upon in 1909. Empyema with stone. Stone overlooked. Cholecystectomy in an Eastern city. Frequent attacks of jaundice after this second operation.

CASE 10. Woman, age 56, operated upon in 1909. Empyema with stone. *Operated later elsewhere.* Nature of operation and later history unknown.

CASE 11. Woman, age 35, operated upon in 1913. Empyema with stone. Cholecystectomy seven months later for intermittent sinus with pain. *Sinus still persists*, but she is now free from pain.

CASE 12. Woman, age 41, operated upon in 1912. Empyema with stones and duodenal ulcer. (Gastroenterostomy also done.) Operated upon a year or more later at another hospital. Cholecystectomy with ligature of pylorus. *Symptoms not relieved by secondary cholecystectomy.*

CASE 13. Man, age 42, operated upon in 1905. Empyema with stones and deep jaundice in a very weak man. Stones probably left in the common duct. *Stones removed seven months later* by a surgeon in the West, with fatal result.

CASE 14. Man, age 29, operated upon in 1912. Acute cholecystitis with stones. Still has *pains*, thought by his physician to be from his appendix, which was not removed.

GALL-STONE CASE NOT CURED BY EXCISION

CASE 1. Woman, age 33, operated upon in 1907. Excision followed by persistent biliary fistula, no doubt due to inclusion of part of common duct in ligature. *Secondary operation* ten months later *for reconstruction of strictured common duct*, followed by death from hæmorrhage notwithstanding transfusion.

CHRONIC CHOLECYSTITIS WITHOUT STONES NOT CURED BY DRAINAGE

CASE 1. Man, age 25, operated upon in 1912. Dyspeptic symptoms persist.

CASE 2. Woman, age 36, operated upon in 1909. Spent most of next two years in bed, probably from some other condition, as no details were secured.

CASE 3. Man, age 41, operated upon in 1908. Had several attacks of colic in next six years.

CASE 4. Man, age 58, operated upon in 1908. Chronic pancreatitis. Common duct drained and sinus persisted for a year. Patient has since been well (five and one-half years).

ACUTE CHOLECYSTITIS WITHOUT STONES NOT CURED BY DRAINAGE

CASE 1. Woman, age 57, operated upon in 1911. Gall-bladder atrophied with small abscess extracystic. *Milder attacks since operation.*

CASE 2. Man, age 47, operated upon in 1912. Empyema without stone. Cholecystectomy about a year later by another surgeon. Result unknown.

CASE 3. Woman, age 44, operated upon in 1905. Empyema. Very prolonged recovery, probably from an overlooked stone in the common duct; entirely well for four years past.

CASE 4. Woman, age 48, operated upon in 1912. Empyema. One year later became jaundiced and was very ill. Passed a stone by bowel and has since been well.

The question may very properly arise as to why 95 per cent of the cases in this series have been drained and only 5 per cent excised. The answer, I think, has a temperamental basis and the principal reason is a certain conservatism or timidity, if you will, in changing a practice which seemed to be giving fairly good results over a period of years.

Of one thing I am reasonably certain, as I look back over these cases and study their histories, and that is that considering the nature of the cases (32 per cent of them being acute) and my lack of experience and ex-

pertness, which was naturally a greater factor in the earlier years, the mortality would have been decidedly higher if cholecystectomy had been practiced in the majority of cases.

Analysis of the 13 uncured cases of chronic gall-stone patients shows that 10 of them would probably have been better off with a primary cholecystectomy; in four of these, stones were certainly overlooked, and in six the symptoms pointed to obstruction of the cystic duct either from stone or stricture.

Of the 14 uncured cases of acute gall-stone patients, four had stones subsequently scooped out. In these and in the great majority of the acute cases the local conditions were such that cholecystectomy was not to be considered.

In the gall-stone cases 78 per cent were females; in the cholecystitis cases 66 per cent. Only two patients were under 20 years of age — a girl of five and one-half years with empyema and a girl of nineteen years with stones and a simultaneous acute appendicitis.

In exactly 100 cases was the previous occurrence or not of typhoid fever noted in the history. In 41 of these. typhoid fever had been an antecedent and in 59 it had not.

No patient was known or suspected to have developed cancer of the bile tract after operation. (Graff and Weinert observed cancerous development subsequent to cholecystectomy in four of their 124 cases.)

While stone was afterward found in ten of my cases — a little more than 3 per cent — there was no good evidence that any of these was a case of true recurrence. Overlooked stone occurs in the practice of all operators in 2 to 5 per cent of cases.

Of the ten cases in which stones were here overlooked, in one, the patient cured himself by extruding 50 to 75 stones from his sinus; in one the stone was passed by the bowel; in three cases the stones were scooped from the gall-bladder after dilatation of the sinus with sponge tents; in one case the stones were removed years after closure by cholecystotomy; in two cases impacted stones were removed by cholecystectomy; in one probably by choledochotomy elsewhere; and in one case the stone probably remains.

TECHNIQUE OF OPERATION

Incision was in most cases through the rectus muscle; in many of the earlier cases Kocher's incision parallel with the costal cartilages was employed, and it did not seem that the muscle section tended to hernia production.

Local anæsthesia was used in a small proportion of cases and only in very weak patients. It was invariably well borne and did not prevent necessary manipulations, but, naturally, as little as was necessary was done.

The common duct was palpated in most of the cases and drained in some with the expectation of finding stone. (Common-duct stone cases are not considered in this paper.) Negative evidence concerning the contents of the common duct was never very confidently relied on.

Much reliance as to prognosis of cure was placed on the flow of fresh bile on the table and within the next few days. Note of this fact was made in 212 cases, and it was found that, when the bile flowed freely from the gall-bladder, only 8.5 per cent were not entirely cured; whereas, in the cases in which the bile did not flow at all, 45 per cent were not entirely cured.

The margin of the opening in the gall-bladder in all cases operated in the last ten years was overwhipped with a catgut suture and narrowed with a stitch so as to tightly embrace the rubber drain, making practically a watertight joint. (Fig. 1).

This overwhipping renders hæmorrhage from this vascular structure impossible. Whenever the fundus could be brought to the peritoneum without tension it was anchored there, and there was no complaint of discomfort to indicate that this was not good practice. I believe this ancient practice in normal cases reduces the liability to adhesions. Where the fundus will not easily reach the parietal peritoneum the gall-bladder is dropped, with the tube secured as described and pictured.

The question of whether the gall-bladder is a perfectly superfluous organ can probably be safely answered in the negative on general principles. Other things being equal, therefore, cholecystotomy should be preferred to

cholecystectomy in all cases. The fact is, however, that other things are *not* equal in the very cases that are under consideration. A gall-bladder that is diseased and is not going to recover is worse than none.

The gall-bladders that were drained in the present series recovered in 81.7 per cent of cases, and 5 per cent more recovered from the drainage operation to be cured by nature or the further efforts of the surgeon.

What end-results are to be expected from cholecystectomy?

Graff and Weinert[1] last year traced 124 of their 130 cholecystectomies and found that only 73.4 per cent were permanently cured; whereas Schulz[2] in a series of 510 cholecystectomies had been able to examine only 145 cases and makes the surprising statement that *not one* had any evidence of recurrence of the former or any other untoward symptoms.

The truth about cholecystectomy probably lies between these two views, and when the balance is struck I think it will be an uncertain quantity and will depend on the skill and judgment of the individual operator.

Finney, with his usual acumen, struck at the heart of this question when he said, "The great objection to cholecystectomy will always lie in the fact that, in cases of subsequent obstruction to the common duct, the other avenue for the passage of bile has been cut off."

When Hans Kehr can state, as quoted by Eisendrath last year at the meeting of the American Medical Association that of 54 cases in which he had examined the common duct, in 32 palpation was negative and yet stones were found; and when Eisendrath can say that, in over half of his cases, when palpation was negative, by opening the common duct he has found stones, then we should have a lively sense of the danger of permanently closing the cystic duct and leaving stones in the common duct to block that important tube.

[1] Beitr. z. klin. Chir., 1914, xcii, 339.
[2] Ibid, 359.

Fig. 1.

CONCLUSIONS

1. Cholecystotomy is not a satisfactory operation, giving but 81.7 per cent of ultimate cures, taking the cases as they come.

2. Cholecystectomy, it is believed, would not be a satisfactory operation if employed in all cases by operators of ordinary skill and perhaps even by the most skillful surgeons.

3. The personal equation enters so largely into this question that it must be conceded by the advocates of cholecystectomy as well as the followers of cholecystotomy (if any still exist) that the practice that is safe for one operator is unsafe for another.

4. As a surgeon's experience increases and as he honestly follows his cases and considers their condition he is more disposed to turn to cholecystectomy; and at the same time he should realize that the too hasty adoption of this course may be attended with an increase in his mortality list.

5. There is a field for both operations, and that surgeon will have most success who will not only consider the condition of the patient but estimate justly his own capabilities.

GONORRHŒAL URETEROPYELITIS; REPORT OF TWO CASES TREATED BY INJECTIONS OF ANTIMENINGITIC SERUM

By MONTAGUE L. BOYD, M.D., Atlanta, Georgia

NUMEROUS reports have been made of the treatment of complications of gonorrhœa with antimeningicoccus serum since Pissavy and Chauvet[1] in 1909 presented to the Societe Medicale des Hôpitaux de Paris two cases treated by injections of antimeningococcus serum. Most of the cases have been of arthritis,[1 and 2] but a number have been of epididymitis and some of septicæmia[3] and acute urethritis. There has been only one case of ureteropyelitis,[4] which was reported by Strominger to the Societe Genito-Urinaire de Bucarest in November, 1911; I find no other cases reported in the literature.

The results obtained in the treatment of the various cases of acute arthritis are reported to be very gratifying; those obtained in the cases of acute epididymitis are perhaps less striking, but nevertheless are excellent and worthy of consideration. The other cases of septicæmia and urethritis are not sufficiently numerous to offer reliable statistics, and a knowledge of the value of the serum in such cases as compared to other methods of treatment can only be obtained by deduction.

The results I have obtained in the two cases of ureteropyelitis that I am here reporting are certainly most satisfactory:

Case 1. (68, J. M. Mc—.) Age 31; mechanic. Came to me April 13, 1912 complaining of aching pain in the lower back and right thigh and increased frequency of urination which came on after a gonorrhœa.

Previous history is of no importance; he was well up to the time of the present illness; no venereal trouble.

Present illness began three months ago with a urethral discharge. The amount of discharge was moderate, and there was no burning on urination. During the third or fourth week after the trouble started had to get up three to four times at night to void, but says that he was drinking a great deal of water, and that the amount of urine passed each time was normal and accompanied by no unusual sensations. The discharge gradually disappeared under injections of protagol and occasional vesical irrigations of potassium permanganate solution.

About three weeks ago, when he was apparently nearly well, without apparent cause he passed some blood after urination accompanied by pain and straining. This continued for about two weeks, during which time some sounds were passed into the bladder, which seem to relieve the discomfort. Coincident with the appearance of the blood he began to void very frequently, every 30 to 40 minutes, but this gradually improved and now he only gets up two to three times at night.

About 10 days ago, during the time the sounds were being passed, he first noted an aching pain in the lower part of the back and in the right thigh. Three days later it was quite severe, of a dull aching character, and accompanied by aching pain in both legs. Since two days ago the pain has been in the right buttock and has been severe enough to keep him awake at night. He feels no pain when going up and down stairs, but when walking on level places there is soreness and pain in right buttock and right thigh.

During the past week he has been getting up only once or twice to void. There is practically no urethral discharge and no more blood in urine. Nearly all of the discomfort after voiding has disappeared — only a little burning left. The bowels have been kept moving freely. He has been very thirsty.

Two days ago received subcutaneous injection of gonorrhœal vaccine.

Examination: Urine cloudy in all three glasses; glasses 2 and 3 contain numerous pus-cells and gonococci. No urethral discharge. *Prostate* slightly swollen and feels tenderer to pressure than normally. No indurations or adhesions. No signs of acute inflammation or abscess. *Inguinal glands* very slightly enlarged. *Scrotal contents* normal. Pressure on the lateral portions of the pelvic bones causes pain in the right sacro-iliac joint. Pressure over this joint from behind is very slightly painful. By rectum this joint can be felt to be tenderer than the left and there is a distinct swelling over it. Temperature (M) 102.5°.

Treatment: Rest in bed. Gonorrhœal vaccines given in six doses from 50 to 400 million. Temperature fell to normal within two to three days, but rose to 99° or 100° after each of the first injections of the vaccines.

[1] Héresco and Cealic. J. d'urol. Med. et Chir., 1912, p. 477.

[2] Hevescu and Strominger. Verhandl. d. Deutsch. Gesellsch. f. Urol., 1913, p. 102.

[3] Strominger (Abstracts in Ztschr. f. Urol., 1911, p. 394). Note. sur un cas de septicémie gonococcique guérie par des infectiones de sérum antiméningococcique. Ann. d. mal. gén.-urin., 1910, ii, No. 21.

[4] D. L. Strominger. Arthrite du coude et urétéro-pyelite [gonococciques, traitées au moyen d'injestions de sérum antiméningococcique. Rev. clin. d'urol., 1912, May. Summary in Ztschr. f. Urol., 1912, p. 880.

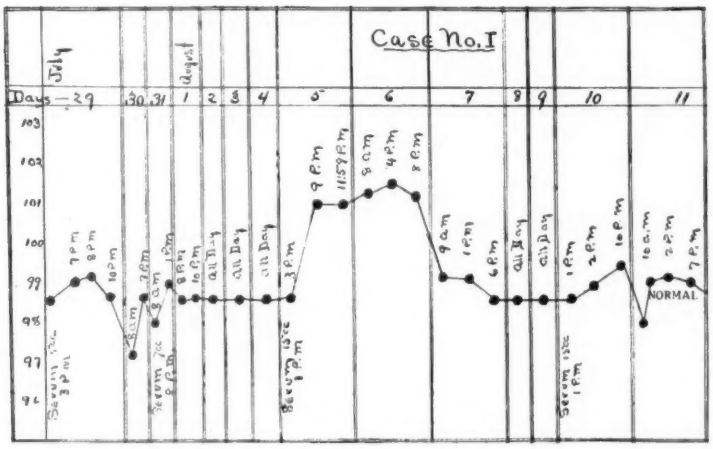

Fig. 1. Temperature chart, Case 1.

April 25 (12 days later): Patient out of bed today. Temperature normal. Joint much better, but still some tenderness and stiffness. Urine still cloudy in glass 3 and contains much pus and many gonococci. No reaction in the urinary tract after the injection of the vaccines.

May 5 (22 days later): Urine no less cloudy and still many gonococci. Joint still slightly sore and stiff. Voids three to four times at night, but drinking much water. For past ten days has been using urethral injections and daily irrigations of the bladder with potassium permanganate.

June 22 (69 days later): Joint has gradually improved, but the stiffness and soreness has not entirely disappeared. Since the urine was still quite cloudy and there were many gonococci still present another course of gonorrhœal vaccines was tried, beginning with 100 million and going up to 600 million. The only reaction noted after their use was sometimes an increased soreness in the joint, a slight headache, a tendency to constipation, and a rise in temperature to 99° or 99.6°, which disappeared in about 24 to 36 hours.

July 11 (88 days later): In spite of the fact that the patient has gained weight and looks to be in good physical condition, the urine has remained full of pus and gonococci. He urinates one to two times at night, but there are no other symptoms of urethritis or cystitis.

Ureteral catheterization: Catheter could not be introduced into the right ureter, although several kinds and sizes were used; trauma avoided as much as possible. Urine from the left contains much pus and many gonococci. Cloudy urine could be seen coming from the right ureteral orifice. Lavage left kidney with silver nitrate solution 1:10,000; practically no discomfort.

July 14 (91 days later): *Ureteral catheterization.* Urine from both sides contains much pus and many gonococci. Left orifice inverted U-shape. Right orifice swollen and puffy, more so than on the 11th. Lavage of both kidney pelves with silver nitrate solution 1:8,000.

July 24 (101 days later): *Ureteral catheterization.* Urine from the left side is cloudier than from the right; many gonococci still present. The right orifice is less puffy. Lavage of both kidney pelves with silver nitrate solution 1:4,000. There is only moderate burning in the bladder following kidney lavage with the silver nitrate and no discomfort felt in the kidneys.

July 27 (105 days later): *Ureteral catheterization.* Cloudy urine from both sides as before, with more cloud in that from the left. Gonococci still present. Right orifice seems more swollen than when last viewed. Lavage with silver nitrate solution 1:2,000 followed by some little burning in bladder.

July 29 (108 days later): Since there seemed to be no improvement in the kidney infection from the use of the lavages it was determined to try injections of antimeningococcus serum; therefore 5 ccm. were injected into the right buttock. As a result of this his temperature rose to 99.3° within five hours, but was normal two hours after that. There was a moderate aching pain in the right sacro-iliac joint and in his eyes. Slight local reaction.

July 31 (111 days later): Injection, 7 ccm. antimeningococcus serum into the buttock. This was followed by no fever and no particular discomfort. Slight local reaction.

August 4 (115 days later): Injection of 15 ccm. antimeningococcus serum into the buttock. Temperature seven hours later 101°. In 24 hours temperature was 101.5°, but after that fell to normal by twenty-four hours later. Reaction at seat of injection rather well marked; sacro-iliac joint quite

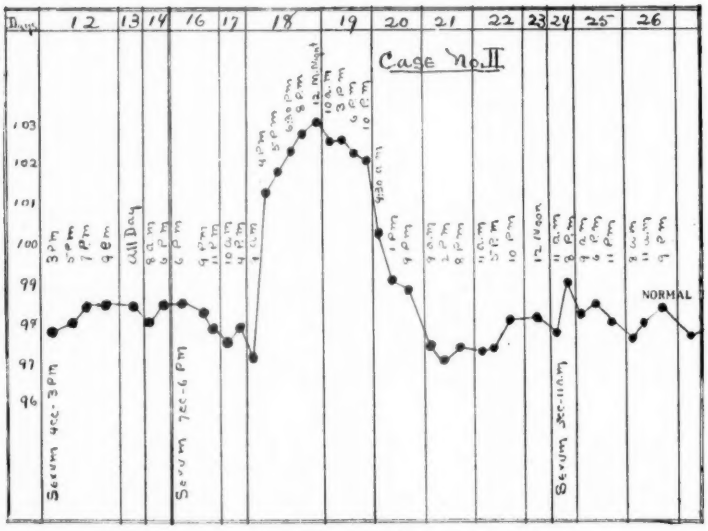

Fig. 2. Temperature chart, Case 2.

sore, aching in back and legs rather severe. Headache and loss of appetite. Slight urticarial eruption over buttocks. Slight increased frequency of urination, but no discomfort. No definite reaction to serum in kidneys.

August 10 (121 days later): Injection of 15 ccm. antimeningococcus serum injected into the buttock. Temperature after this injection rose to 99.4°, but no higher. Normal within 33 hours. Local reaction very severe — marked soreness, swelling and induration. General reaction mild — very little soreness in sacro-iliac joint and hardly any malaise.

The urine. During these injections there was from the first a gradual improvement in the condition of the urine; it became clearer after each of the first two injections, and after the third, which was followed by the severe reaction, it became almost completely clear. After the fourth injection it was completely free from pus and gonococci within five days. During the time that the injections of serum were being given, local treatment was discontinued almost completely — the patient using a hand syringe for the injection of a weak solution of protagol into the urethra. Still shreds in glass 1; no organisms.

The sacro-iliac joint. There was an improvement in the arthritis from the time the patient first came to me up to the time of the injections of the antimeningococcus serum. There was still, however, some swelling about the joint, particularly observable by rectal palpation — a soreness which was noted on unusual muscular exertion and on squatting and stooping. After the injections of the antimeningococcus these remaining symptoms were no longer to be found; the arthritis was apparently completely cured.

March 1915 (almost 3 years later). The patient has had no recurrence of either the kidney infection or the arthritis.

CASE 2. (A 327, F. F. W.) Age 20; college student. Patient referred to me December 23, 1914, complaining of a continued gonorrhœa, with cloudy urine. *Previous history* of no importance. Healthy young man who has had no previous venereal infections.

Present illness began with a gonorrhœal urethritis about seven months ago. Discharge rather profuse for three to four weeks, but there was only slight burning or discomfort on voiding. At one time he had to get up two to three times at night to void; this continued for a week or ten days (he was drinking a good deal of water at the time), and during that time there was a slight burning after voiding. No hæmaturia, and no adenitis or other complication at the time.

Treatment was continued for four months (until September 1914) because of a slight discharge which would disappear for only a few days at a time. He was then considered practically well, and was operated upon for appendicitis. Very shortly after the operation there was a recurrence of the discharge and he was declared to have a pronounced gonorrhœal urethritis again. Under treatment the discharge disappeared in a few days, except for a slight amount which has remained more or less constantly in evidence up to the present time.

He is able to give no information worthy of note concerning the length of time his urine has been cloudy.

The treatments which he has received have been daily irrigations of the bladder with solutions of potassium permanganate. No massage of the prostate and no instrumentation of the urethra.

Present condition: General health good. No increased frequency of urination. Slight urethral discharge and cloudy urine.

Examination, December 21, 1914: *Urine* cloudy in all three glasses; acid. Microscopic examination shows numerous pus-cells and numerous gonococci; besides the gonococci there are a few diplococci which on repeated examinations are seen to be gram positive. *Urethra* presents a stricture about the midpart of the pendulous portion — will admit a 16 F. instrument.

Bladder and kidneys. A small soft rubber catheter was introduced into the bladder after the urethra and bladder had been washed out thoroughly (without instrument). The bladder was then again thoroughly cleansed and examination made of the urine which had collected in the bladder; it was repeatedly found to be very clouded with pus and gonococci. This examination was repeated after a rectal investigation of the prostate and seminal vesicles to eliminate them as sources of the organisms and pus. I was then satisfied that there was a gonorrhœal ureteropyelitis.

January 12, 1915: Antimeningococcus serum to the amount of 4 ccm. was injected subcutaneously into the forearm. There was no subsequent rise in temperature above normal, no general reaction, and no evidence of reaction in the genito-urinary apparatus. At the site of the injection there was a quite marked soreness, swelling, and redness which extended 10 to 15 cm. in all directions.

January 16, 1915: Injection of 7 ccm. of antimeningococcus serum into the buttock at 6 p.m. No rise in temperature above normal for 48 hours. Although there was no fever on the day after the injection, there was a severe headache and backache and a general malaise. On the next day he still was quite weak and by noon the headache became very severe. His temperature was not taken after 8:15 a.m. until 4:15 p.m., when it was found to be 101.4°, and it continued to rise, until at midnight it was 103°. About 36 hours later it was normal. There was a slight increase in the frequency with which he voided, but it was not noted until my questioning brought it to his attention. Local reaction fairly well marked and areas of urticarial eruption appeared over buttocks and on both thighs.

January 23, 1915: The urine is much clearer, but still a few pus-cells and a few gonococci can be found.

January 24, 1915: Injection of 5 ccm. of antimeningococcus serum made into the buttock at 11 a.m. Temperature rose to 99° in the evening and was normal again the next day. Local reaction not as marked as with the preceding injection and the urticarial eruption which appeared was not as extensive and was found only on the buttock. No general or urinary reaction; no headache or malaise.

January 31, 1915: Urine very nearly clear in glasses 2 and 3; glass 1 contains some shreds which are free from diplococci; glass 3 a few diplococci which are gram positive. Meatotomy done to admit easily a 30 F. sound. An 18 F. sound passed as far as the bladder, but was followed by some bleeding. Injection, 5 ccm. antimeningococcus serum. Temperature rose to 99° on the following day — normal thereafter.

February 14, 1915: Urine clear but for a few shreds in glass 1. Meatotomy wound healed. Prostate by rectum slightly enlarged, and contains a good many pus-cells in the prostatic secretion (a moderate number of lecithin bodies); but a stained specimen shows no organisms.

A 19 F. sound was passed through the stricture, which was about the largest that could be introduced without using force.

The size of the dose in the hands of other observers has been usually 10 to 20 ccm., although as much as 40 ccm. at a dose has been given. The total amount varies between 30 to 100 ccm., usually between 40 to 60 ccm. The initial dose has usually been 10 ccm., less frequently 20 ccm. Since there exists the possibility of the production of anaphylaxis and because of the location of the infection in such important organs as the kidneys, I have made my initial dose very small and followed it with another comparatively small one. It was my intention in my first case to begin with a small dose and increase the size gradually until sufficiently large to bring about a marked reaction. In the first case this was reached at 15 ccm. and in the second with 7 ccm. and without any evidence of an acute pyelitis or an acute nephritis. The total amounts of my injections were 42 ccm. in the first and 21 ccm. in the second case.

The method of making the injection varies; many make it subcutaneously into the tissues about the involved joint. The small doses I give now subcutaneously, and the larger doses into the buttocks.

Héresco and Cealic state that the temperature rarely exceeds 100.4° to 101.4°. One of my cases, however, went to 103°, while the other reached only 101.5°, but it would seem that with larger doses I might obtain a more severe reaction and a higher temperature.

I would like (Case 1) to take this opportunity to direct your attention to the fact that the sacro-iliac joint is readily examined by

rectum in the majority of cases. The periarticular swelling was readily made out in this case. I was able a year or two ago in a case of sacro-iliac dislocation to make a diagnosis of the condition by rectum after it had been overlooked in an X-ray examination.

An interesting point in Case 2 was the secondary infection with a gram negative diplococcus, which disappeared only after the performance of the meatotomy and the beginning of the dilatation of the stricture. It is already understood that such secondary infections occur, and it has been pointed out that, persisting after the gonorrhœal organisms disappear, they may be considered to have been the original and only infection, thus misleading us in our conclusions concerning the frequency of gonorrhœal ureteropyelitis. I was unfortunate enough to have the differentiation of the organism overlooked by the bacteriologist who made my cultures.

The gradual fall below normal in temperature in Case 2 after the second injection, which preceded the rise to 103°, and the long time between the injection and the beginning of the rise in temperature are interesting points which I am not prepared to explain to my entire satisfaction.

RECTOVESICAL AND ENTEROVESICAL FISTULÆ[1]

By JOHN H. CUNNINGHAM, Jr., M.D., F.A.C.S., Boston, Massachusetts

RECTOVESICAL and entrovesical fistulæ are uncommon conditions, and it is possibly on this account that so little is known concerning them. It is the purpose of this paper to consider briefly the different phases of the subject and to record cases which have come under my care, together with the deductions to be drawn from the cases recorded in medical literature.

The presence of fæcal matter in the urine is of quite as much interest to the urologist as to the proctologist; yet the subject thus far has mostly been considered in the literature of the latter's specialty. That the condition is rare is evident from the fact that Pascal, in an excellent thesis which considered the literature of the subject up to the year 1900, could find but 286 cases of this affection; and Pristavesco, who searched the literature from this date to 1912, could add but 42 cases. Since that date I have been able to find but 8 additional cases, making a total of 342, including my own series of 6 patients. Of this series, about 75 per cent of these cases were females and 25 per cent males.

From the *pathological standpoint*, when air and fæcal matter escape with the passage of urine there can be no doubt that a communication exists somewhere between the bladder and some portion of the intestinal canal; and etiologically the lesions most frequently giving rise to the condition result from intestinal diseases, such as malignant growths and tuberculosis, rectal ulcerations, perirectal abscesses, diverticulitis, appendix abscesses, and rarely actinomycosis and syphilis. The lesions resulting in fistulæ are less often in the bladder, and when the primary cause of the perforation is here located it is usually the result of malignant growths, vesical tuberculosis, or trauma. I have observed one case of tuberculosis of the seminal vesicle resulting in an abscess which perforated into both the rectum and the bladder, and I have also observed one case in which a prostatic abscess resulted in the establishment of a vesicorectal communication; but in most instances when a prostatic abscess ruptures into the intestinal and urinary tracts the rupture takes place into the urethra, whereby a recto-urethral fistulæ is established. Cripps mentions two cases in which stone in the bladder may have been the cause of the fistulæ. Pelvic abscesses originating from perforation of the rectovesical septum, and traumatic causes such as gunshot and stab wounds, fractures of the pelvis, and the now obsolete method of tapping the distended

[1] Read before the American Urological Association, Baltimore, April 15, 1915.

bladder through the rectum, have been recorded as etiological factors. Earle mentions a case where a rectovesical fistula was caused by injury to the bladder and rectum in performing a vaginal hysterectomy. Of the causes producing the fistulæ a variety of acute inflammations, carcinoma, tuberculosis, and traumatism, are the most common, while actinomycosis and syphilis are rare.

The location of the opening in the intestinal canal is most common in the rectum, nearly half of the collected cases being in this structure. The next most common location is in the sigmoid, and next in frequency are the small intestine and cæcum. The location of the opening in the bladder is most frequently situated in the region of the trigone, yet many cases have been observed to be on the posterior wall and a few on the summit of the bladder. The fistulous tract between the bladder and intestinal canal may be a direct communication or a long and tortuous sinus. When of the former type it is generally the result of carcinoma or tuberculosis, originating in either the bladder or the rectum; in the latter it is more frequently the result of an abscess originating between the bladder and rectum and opening into these organs by apertures situated at different levels.

With the modern means of diagnosis, the differentiation of vesicorectal and urethrorectal fistulæ is not as difficult as formerly; for aside from the fact that urethrorectal fistulæ have their opening low down in the rectum (often within the reach of the finger) and rectovesical fistulæ high up in the bowel, examination of the bladder with the cystoscope, of the urethra with the urethroscope. and of the rectum with the proctoscope and sigmoidoscope, should establish the location of the opening without question. The location of the opening in the bladder by inspection is easier of accomplishment than is the opening in the rectum, as the folds of mucous membrane may cover up the rectal opening and it may be necessary to inject the bladder with a colored fluid to observe its point of exit in the rectum through the proctoscope.

Symptomatically, the presence of gas and fæcal matter in the voided urine or the presence of urine in the rectum is pathognomonic, and a careful inquiry into the history usually reveals symptoms referable to preëxisting rectal or bladder affections prior to the perforation. After the perforation has occurred, the symptoms are generally aggravated, and frequent and painful urination dependent upon the resulting cystitis occurs. If the fæcal matter which escapes into the bladder is in formed masses, tenesmus results. Later, secondary general symptoms occur and, if the suppurative process in the bladder is allowed to continue, renal infection with its train of symptoms takes place and may terminate the patient's life. The symptoms dependent upon the presence of urine in the rectum are those of a proctitis and are seldom of much consequence.

The *prognosis* must necessarily depend upon the nature of the primary lesion to which the fistula is secondary. It is naturally most unfavorable in cases in which carcinoma or tuberculosis is the primary cause. In instances in which the communication is due to an inflammatory or traumatic factor, the prognosis is far more favorable; for these cases are amenable to treatment either radical or palliative, and in a small percentage a spontaneous cure has been effected.

Treatment. This is best considered as operative, radical and palliative, and non-operative. The form of treatment must depend largely upon the nature of the etiological factor producing the fistulæ. When the primary cause is traumatism or an inflammatory process, such as simple ulceration, abscess, or rectal stricture, operative measures offer much; but when the intestinovesical communication is due to carcinoma or a tubercular process originating either in the bladder or alimentary canal, operative measures are less often followed by success. In instances where the fistula appears to have followed the rupture of an internal abscess or is due to tubercular ulcerations or syphilis, spontaneous healing under appropriate non-operative treatment has been known to take place.

The method of operative treatment must depend primarily upon the nature of the pathological process producing the fistula and a determination prior to operation of the

location of the opening within the gut. The possible operative methods at our command are —

1. Abdominal section, separation of the intestines from the bladder at the point of union, and repair of the opening in both organs; or if necessary a resection of the bladder and gut so as to include the fistulous tract, and repair of the incisions by the method most appropriate in the individual case. This operative procedure is suitable in traumatic and simple inflammatory processes and occasionally in certain cases where the communication is due to carcinoma or tuberculosis.

2. Perineal operations through the vagina or perineal surface in cases where the communication has been demonstrated to be low down in the rectum. Operations conducted from this region have seldom permitted of closing the rectal and vesical openings; but by separation of the adherent gut from the bladder, packing the wound, draining the bladder by a retained catheter, packing the rectum above the rectal opening and preventing the bowels from moving by a light diet and opium, has proved to be a successful method of dealing with this condition in some instances. This form of treatment, like the previous method, can only be expected to be followed by success when the primary cause of the fistula is traumatic or the result of the rupture of an internal abscess or simple ulceration, and is not to be undertaken when the primary cause is carcinoma or tuberculosis.

3. Colotomy, with the object in view of diverting the flow of fæces from the bladder. The important point to be determined before performing colotomy is the location of the intestinal opening; for obviously if the communication is in the small intestine or cæcum, colotomy would be of no value. By so diverting the fæces from the bladder, spontaneous closure of the communication has been observed, yet this palliative procedure should be reserved for cases where the communication is the result of carcinoma or tuberculosis.

4. Suprapubic cystotomy, with the end in view of allowing free drainage for the fæcal contents of the bladder. This palliative measure, which has been seldom employed, should be reserved for extensive carcinomatous growths of the bladder where little else can be done for the relief of suffering. The fistulous opening has never been successfully closed by the suprapubic route.

Non-operative treatment consists solely in the employment of certain measures which tend to make the patient's condition more tolerable. These non-operative palliative measures may be employed with benefit in the early period following the establishment of the communication in benign cases, but are of more service in the cases in which the fistula is due to tuberculosis or carcinoma, where for whatever reason the enumerated forms of operative treatment are inadvisable. In cases where non-operative methods must be employed for whatever reason, the diet should be of such character as to leave the smallest possible residue and yet supply the proper amount of nutrition. As a rule an effort should be made to keep the bowels confined for several days and then to empty them by the administration of such drugs as are conductive to a loose bowel movement, together with rectal injections. Daily or more frequent washing out of the bladder is of much value in relieving the vesical symptoms when the condition is tubercular; and the addition of strict hygienic measures, urinary antiseptics, and tuberculin should be employed.

In my series of six cases, three were due to the rupture of internal abscess; two were females, and the primary cause was disease of the pelvic generative organs. In the male of this class the primary cause was a prostatic abscess, and in this case no operative measures were undertaken. This patient is a physician and during the past ten years has had periods in which the communication has been alternately opened and closed. A cystitis has been constantly present in some degree, though not causing distressing symptoms, and he has remained in excellent general condition. In one of the females the communication was attacked through the vault of the vagina, and the opening was permanently closed. The other female was operated upon through the abdomen while in a dan-

gerously ill condition. An ernormous pelvic abscess containing at least two quarts of pus was evacuated. A communication between some portion of the bowel and the bladder took place six days following the operation, but by constant bladder drainage and irrigation through the abdominal wound the communication healed in three weeks.

I have observed one case, a male, in whom the communication between the bladder and rectum was tubercular. By strict attention to diet, hygienic measures, and bladder irrigations, the communication healed and remained so for years; the patient died of a general tubercular process. In two cases the primary cause of the fistula was carcinoma — one a male and one a female. In the male the growth was unquestionably primary in the bladder, and a suprapubic cystotomy was performed simply to relieve suffering. The symptoms were considerably relieved, but the patient, who was in very bad condition at the time of operation, died thirty-two days following the operation. The remaining case of this class had an adenocarcinoma primary in the sigmoid and multiple fibroids of the uterus. An abdominal section was made — a hysterectomy had to be performed before the fistula could be dealt with. About one-fourth of the bladder and five inches of the sigmoid was resected. The bladder wound was closed by suture, and the cut ends of sigmoid were united by an end-to-end anastomosis. An uneventful recovery followed. The details of these cases are here appended.

It may occur to many that such operations in the field of the proctologist, the gynecologist, and the abdominal surgeon as were necessary to the successful operative treatment of the cases here mentioned may hardly be considered to be within the genito-urinary surgeon's province, yet no one can dispute the fact that the diagnosis of the condition of fæces in the urine must necessarily command his attention; and in my opinion this condition belongs properly to the genito-urinary surgeon, who should be equipped with the skill necessary to relieve the condition.

Case 1. *Fistula due to a pelvic abscess.* Woman, age 26, Long Island Hospital, September 22, 1904. There was a past history of gonorrhœa four years ago and again eight months ago. Since the latter infection there has been much pain in the lower back, especially in the right side — most marked at the time of menstruation, and a moderate amount of constant vaginal discharge. During the past six months there has been frequency in urination which has gradually increased and during the past week has been every half-hour during the day and night. The temperature has been of a septic character, rising and falling between 100° and 102° with severe pelvic pain. A vaginal examination showed a pelvic mass filling the posterior vault of the vagina, which was extremely tender, and there was tenderness and spasm with some rigidity of the muscles in the lower part of the abdomen. The urine showed a large amount of pus and was in other ways the urine of a severe cystitis.

A vaginal section evacuated several ounces of thick pus. The temperature fell following the operation and the patient's general condition gradually improved. Two days following the operation fæces and gas were passed by the urethra and from the incision in the vaginal vault. The patient's general condition continued to improve, however, and two weeks following the operation the patient was again etherized and a cystoscopic examination demonstrated the opening into the bladder to be about two inches above the right ureteral orifice slightly to the outer side of perpendicular line. The hole in the rectum could not be seen with the proctoscope, but a methylene blue solution injected into the bladder while the proctoscope was still in the rectum was seen to enter the rectum at a distance of about six inches from the anus. The opening of the rectum was on the anterior surface. The methylene blue solution also escaped through the vaginal incision, which had contracted so that it would admit only a large-size probe. The vaginal sinus was opened by blunt dissection without opening the peritoneal cavity, and through it a probe could be passed in one direction into the rectum and in another into the bladder. The cavity was swabbed out with crude carbolic acid followed by alcohol and the cavity packed with iodoform gauze. The anus was dilated, and through a rectal speculum the rectum was wiped with sponges wet with hydrogen peroxide; a rubber tube eight inches long and covered with iodoform gauze was placed in the rectum so as to cover the rectal opening. A self-retaining catheter was placed in the bladder. The patient made a good operative recovery. She was kept on a liquid diet and the bowels were confined by a pill opii night and morning. The vaginal packing was not removed for three days; then a smaller iodoform packing was replaced and changed daily for five days. After this no further packing was placed in the vaginal wound, which was much diminished in size and with but little discharge. The rectal tube was removed on the tenth day, but the catheter was left in the bladder and irrigation three times a day, of two ounces of potassium per-

manganate, which had been instituted two days after operation, was continued. Vaginal douches were begun after the packing in the vagina was discontinued. The bowels were moved on the twelfth day by catharsis and an oil enema, although there had been some escape of fæces through the anus previous to this time. There was no escape of fæcal matter from the vagina. The bladder drainage was discontinued on the sixteenth day, at which time the vaginal wound had closed; following the emptying of the bowels, the bowels were again prevented from moving by large doses of opium. The urine following the discontinuation of the bladder drainage still showed a cystitis of moderate severity. The communication between the bladder and rectum never reëstablished itself. The patient left the hospital three months after the operation, with no symptoms except a backache which was probably dependent upon the pelvic adhesions. These she refused to have remedied by further surgical interferences.

CASE 2. *Fistula due to internal abscess.* Woman, age 34; seen in consultation with Dr. Douglas Lithgow, April 10, 1910. The past history reveals the fact that six years ago the patient had a swelling in the right lower portion of the abdomen which was diagnosed as fibroid of the uterus. She refused an operation at that time, but had daily massage of the mass with ointments for two months, at the end of which time the mass had entirely disappeared and she remained well until the present illness. Menstruation has always been regular, of four days' duration, and occurring every seventeen days.

Sixteen days ago the patient became drenched in attempting to shut off the water escaping from a burst water pipe. The day following she had severe pain in the lower abdomen and the next day a severe chill. Three days after, she called Dr. Lithgow, who found her temperature 102° and the pulse 103. The abdomen was tender everywhere, with spasms. I then saw the patient. The general appearance was that of sepsis. A vaginal examination showed the cervix close to the pelvic bone, the posterior cul-de-sac bulging and very tender. An indefinite tumor mass, round in outline and extending to the umbilicus, could be felt. Its exact character could not be determined because of the tenderness and rigidity of the abdominal muscles. The patient refused operation and for two days the local signs changed but little, but she failed rapidly.

Operation. Trendelenburg position. Median incision showed a tumor about the size of one's head. Omentum and intestines were much adherent to the mass. In separating them a cyst the size of a grapefruit was ruptured, with the escape of clear fluid (probably an ovarian cyst). In freeing the omentum from the mass a large abscess was opened and some of the pus escaped into the abdominal cavity. This was swabbed out and the abdominal cavity packed off with large strips. The abscess sac was found to be behind the uterus, adherent to it and to coils of intestines in the pelvis. Two smaller abscesses the size of oranges opened into the larger ones. The intestines bulged into the sac with sac wall covering them. The sac was sewed to the abdominal wall at the lower end of the incision. It was swabbed out with alcohol and packed with gauze. Two strips were placed, one in each flank above the sac. The wound was partially closed by deep catgut and superficial silkworm sutures. The patient was kept in Fowler's position for five days.

Much to our surprise, the patient gained rapidly following the operation; but on the seventh day fæces and gas were passed with the urine, and fæces appeared in the abdominal wound. A large De Pezzer catheter was placed in the bladder and bladder irrigation was carried out every four hours. The abdominal wound was irrigated every four hours also. The patient continued to gain in general condition. The fæcal fistula closed twenty days later and at the same time the fæces and gas disappeared from the urine, although a cystitis remained for about two months. The abdominal wound was entirely healed thirty-six days following the operation. The patient has remained in excellent health and at present has no urinary or intestinal symptoms and the menstrual periods occur as previous to operation. There is a small abdominal hernia at the bottom of the wound scar.

CASE 3. *Fistula due to a prostatic abscess.* Male, age 39, a physician; had gonorrhœa at the age of twenty, lasting six months without treatment or complications. Another attack at twenty-four, lasting four months without regular treatment. Some weeks after onset patient sat down hard and felt something break in the rectum, and considerable thin cloudy fluid came from the penis; and two days later, after coitus, active bleeding took place from the urethra; about six ounces of blood was lost, but there were no other symptoms. At the age of twenty-nine he had another attack of gonorrhœa which was not treated. About four months after the onset, and while the discharge was still active, the patient drank a large amount of champagne. Two days later, symptoms of acute infection of the prostate were experienced. These increased for about a week and were accompanied by marked prostration and increased frequency and difficulty in urination. About two weeks later the abscess broke into the rectum and into the bladder. Aside from the presence of pus, gas, and fæces in the bladder and urine in the rectum the patient's condition was more satisfactory. The pain and difficulty in urination were much relieved with the establishment of the fistula. The communication remained open, so that there was a free communication for over a year. The fistula gradually diminished in size, so that little fæcal matter came into the bladder and much of the urine escaped into the rectum. Aside from taking urinary antiseptics the patient had no treatment. Four years after the establish-

Fig. 1. Shows point of anastomosis of sigmoid with the bladder.

ment of the fistula the patient consulted me. At that time the urine was very cloudy from pus, alkaline, with one-half of one per cent of albumin. There were no renal elements and the urine was that of a chronic cystitis. Frequency was four or five times a day and once at night. There was no pain and about half of the urine was passed from the penis and half from the rectum. The patient's general condition was excellent. The physical examination showed the external genitals to be normal except for the moderate varicocele on the left. Rectal examination showed the prostate to be small and atrophied. The left vesicle was normal, but just below the right vesicle there was an indurated area which ran as a hard shelf of tissue about a centimeter wide downward and inward toward the median line. The communication in the rectum was located in this indurated area.

A cystoscopic examination revealed no residual urine, but the instrument during its introduction met three distinct jumps in the prostatic urethra. Bladder capacity, eight ounces. Just below the right urethral orifice on the trigone there was an ulcerated area about the size of a ten-cent piece with fibrin adherent to its surface. The remaining portions of the bladder showed a chronic cystitis.

For about one month the patient was given daily irrigation of the bladder and the urethra dilated to twenty-eight Fr. with some improvement in the cystitis.

At the present time, ten years after the establishment of the fistula, a few drops of urine still escape from the bladder into the rectum. A cystitis has existed at all times in varying degree, without causing symptoms other than some frequency and tenesmus at times, but at no time has there been any discomfort or irritation of the rectum since the breaking of the abscess. This patient is in excellent general health.

CASE 4. *Fistula due to tuberculosis.* Male, age 45; seen with Dr. Thorndike, for cystoscopic examination. I am indebted to him for the following history. The patient was tubercular from early childhood. In 1893, Dr. Edward Bradford did a laminectomy for Pott's disease. A few years later the patient developed a tubercular epididymis, for which Dr. Thorndike did a castration; a few years subsequently he removed the other testicle for the same disease. In 1902 the patient developed symptoms of a tubercular cystitis and in the summer of 1903 gas and fæcal matter appeared in the urine, and the bowel movements were watery from the presence of urine in the rectum. Regular irrigations of the bladder resulted in the apparent closure of the communication, and on October 1, 1903, I cystoscoped the patient and observed the condition to be as follows:

Cystoscopy under ether. Six ounces of distending medium. Trigone distinct with some hypertrophy of the bladder wall and increased injection of the mucous membrane everywhere. Left urethral orifice was normal in size and function. The

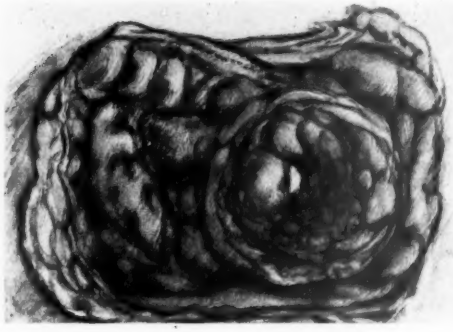

Fig. 2. Shows disease in bladder and intestine about the sinues.

right urethral orifice was normal in shape and directly below it, on the trigone, was a pearl-colored shallow ulcer with deep-red, clean-cut, and slightly indurated edges about 1 by 1.5 cm. in size. This area corresponded to the region of the lower part of the right seminal vesicle, which by rectal examination was found to be much enlarged and tubercular in character. The prostate was everywhere covered with nodules the size of small peas. Rectal examination showed a small indurated area in the median line just inside of the indurated right tubercular vesicle, which was continuous with the right lobe of the prostate. The prostate was nodular in character and unquestionably tubercular.

The fistula never reëstablished itself. The patient died in the winter of 1914 from the results of a general tuberculosis.

CASE 5. *Fistula due to carcinoma, primary in the bladder.* Male, referred by the late Dr. John Flint, September 6, 1905, with the history that he had always enjoyed good health until the past two months, during which time he has had periods of hæmaturia lasting from one to three days, sometimes painless and at other times painful, especially when clots were passed. There has been a slight frequency in urination for the past six months; at times, especially when the bowels were constipated, he experienced a heavy, dull ache in the perineum, down the backs of the legs, and in the rectum. The constipated movements during the past month have often been covered with blood-streaked mucus and the patient has recently developed hæmorrhoids.

Five days ago the patient, after a constipated movement of the bowels, had considerable pain in the perineum and shortly after there was an imperative desire to urinate. Gas escaped with a small amount of urine. The desire to urinate persisted, and, by constantly straining, some fresh blood and a mass of fæcal matter the circumference of a pencil and about two inches long was passed by the urethra. A doctor was called and morphine was administered, also a physic was given, and the following day the severe symptoms had subsided somewhat; but frequent and painful urination persisted and the urine continued to contain gas, fæces, and blood in large amounts. Blood was also present in the bowel movements. When seen by me, the patient was comfortable except for the frequent urination. He was cachectic in general appearance and weighed one hundred and thirty pounds. Rectal examination with the finger failed to detect the fistulous opening, but the proctoscope located it as an indurated, rough-edged, bleeding area on the left anterior surface of the rectum at a distance of six inches from the anus. A cystoscopic examination was not very satisfactory, as the distending medium escaped rapidly into the rectum. Enough was seen, however, to establish the fact that the growth was extensive.

Fæcal matter continued to be emptied into the bladder, and the tenesmus was so severe that the patient began to lose rapidly in general condition. A suprapubic cystotomy was therefore performed under ether anæsthesia. The carcinomatous mass occupied most of the posterior surface of the bladder and fæcal matter was everywhere adherent to it. The opening into the rectum was found to be on the posterior wall to the left of the median line. A large part of the growth was scooped out with the hand and the remainder burned with the actual cautery to control the hæmorrhage. The bladder was packed with iodoform gauze and a long rectal plug was placed in the rectum. The following day the rectal and bladder packing had to be removed on account of pain. The patient lived thirty-two days following the operation. He was quite comfortable. Fæces escaped from the wound, but by frequent irrigation he was kept clean and without the distress which was intolerable prior to operation.

About a week before the end, the patient became stupid, slept most of the time, and took nourishment reluctantly. The pulse became weaker and the temperature subnormal. The urine was unquestionably much diminished, and twenty-four hours prior to death there was extreme, if not entire, suppression of the urine.

CASE 6. *Fistula dependent upon adenocarcinoma of the sigmoid.* Maiden lady, age 39; referred by Dr. David Eldridge, February 7, 1915. The patient had always enjoyed excellent health except for occasional periods of constipation. February 3, 1915, she became unwell and the day following noticed that she passed gas from her bladder during micturition. The day following the patient passed gas and some formed fæcal matter mixed with the urine. Dr. Eldridge was called and found that the patient's urine contained fæcal matter, considerable blood, and some pus. She was given a laxative, which increased the amount of fæcal matter in the urine. On February 13, ten days after the onset, I made an ether examination.

The patient was small, but fairly nourished. An irregular fibroid of uterus of considerable size

could be palpated through the abdominal wall. This was more clearly felt in a bimanual examination. The proctoscope passed for a distance of sixteen inches failed to reveal the opening into the rectum.

A cystoscopic examination showed the communication within the bladder to be located about two inches above and slightly to the left of the left urethral orifice. The area about the fistula was irregular, slightly elevated, indurated, and about the size of a twenty-five-cent piece. It looked not unlike a sessile carcinoma. The remaining portion of the bladder showed acute cystitis. A solution of methylene blue was injected into the bladder and was found to escape into the rectum, but at a point above the end of the proctoscope.

Operation, Hart Hospital, February 19. Patient in Trendelenburg position. Median incision beginning over the pubis and extending upward four inches. The sigmoid was observed winding around the left side of the fibroid mass and attached to the posterior surface of the bladder about two inches to the left of the median line. The omentum was adherent to the posterior surface of the bladder and fibroid uterus. This was freed and a hysterectomy was performed. The uterus contained multiple fibroids and was irregularly the size of an average grapefruit. The intestinovesical union could then be more carefully examined. It was found that there was an indurated area chiefly on the intestinal side of the junction. This indurated area formed a mass involving about one-half the circumference of the sigmoid, which was slightly dilated and continuous as a ring-shaped mass in the bladder wall, the bladder infiltration being of a lesser extent than in the intestinal wall.

A clamp was placed on the bladder so as to include the wall two centimeters beyond the indurated area; and this portion of the bladder was cut away, thus freeing the sigmoid, with the resected portion of the bladder attached. The cut bladder walls were sutured with the clamp still in position by a running catgut suture. The clamp was then removed and another running catgut suture placed so as to enfold the cut edges. The sigmoid could then be freely drawn out of the wound. Clamps were placed two inches beyond either side of the indurated area and this portion of the sigmoid was removed together with a V-shaped piece of the mesentery. An end-to-end anastomosis was done. No nodes could be palpated in the mesentery, liver, or pelvis. A drain was placed to the anastomostic area through a stab wound. The abdominal wound was closed and a self-retaining catheter placed in the bladder. Pathological examination of the specimen showed adenocarcinoma of the sigmoid and bladder, primary in the sigmoid.

The patient made an uneventful recovery, except that there was a slight infection in the upper part of the wound. The abdominal drainage was removed on the third day and since then the bowels have moved voluntarily or by medication daily.

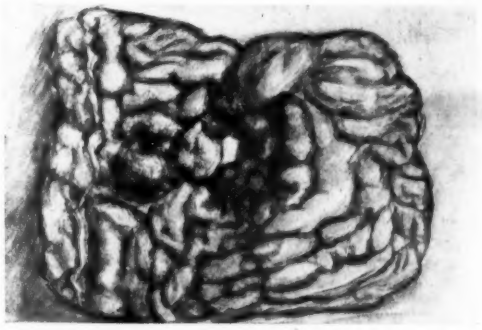

Fig. 3. Shows the disease in the bladder and intestine about the sinues.

The patient left the hospital in twenty days in excellent condition. At the present time a slight cystitis persists.

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DEPARTMENT OF TECHNIQUE

DUODENO–JEJUNOSTOMY WITH EXCLUSION OF UPPERMOST JEJUNAL LOOP FOR ANGIOMA OF THE DUODENO–JEJUNAL JUNCTION AND UPPER JEJUNUM

By EDWIN BEER, M.D., F.A.C.S., New York
Surgical Service, Mt. Sinai Hospital

THE following case is placed on record not only because of the rarity of the condition, but also because of the unusual operation performed.

In a review of the literature of these cavernous tumors, a number of cases are found in which the patients had bled to death. Most of these tumors, as far as one can judge from the description, have been small and limited to the inner wall of the intestine.

According to Nothnagel, of all benign growths angiomata lead to the most severe bleeding. According to H. Benneke,[1] the literature contains reports of twenty cases of these tumors found in children and adults. He states that they were found in all parts of the alimentary tract and are frequently multiple. In a number of cases, a fatal bleeding led to the death of the patients.

In McCallum's[2] article, the author refers to another type of hæmangioma or angioma, in which the small tumors are multiple and scattered throughout the intestine. In the case that he himself reports, he counted as many as forty such small tumors measuring 7 to 8 mm. in diameter.

The history and operation in the case here reported is as follows:

Female, 19 years old, admitted to Mount Sinai Hospital, July 8, 1914. Chief complaints: Pallor, weakness, blood in stools. Past history: Patient has had numerous attacks of tonsillitis. Has never menstruated. For the past five years there has been gradual increase in pallor and weakness, with many attacks of faintness. There was frequent epistaxis. A year ago the fainting spells were accompanied by nausea, and patient vomited incessantly regardless of meals. Her condition became so bad that she went to the hospital, where she had several hæmorrhages from the bowels. In July, 1913, patient had been in the hospital where she was treated for anæmia. At that time her blood picture was that of anæmia. She left the hospital August 23, 1913, and felt well till eight weeks before the present admission, when she began to feel weak and vomited both solid and fluid food. Shortly before admission she again passed blood in her stools in large amounts, and on several occasions vomited blood.

Physical examination, July, 1914. A small-sized, but well developed young girl who presented all the signs of a severe secondary anæmia. All attempts to discover the cause of this anæmia failed. There were no ova found in the stools; sigmoidoscopy was negative. Test meal was practically normal; so was her urine. Owing to the continued loss of blood, the patient's hæmoglobin fell till it reached 17 per cent. She was then transfused and transferred from the medical side of the hospital (service of Dr. Libman) to the surgical side (service of Dr. Beer). No positive diagnosis of the source of the blood had been made. The patient had passed blood by the rectum, as well as per os.

The differential diagnosis rested between (1) a silent bleeding duodenal ulcer; (2) a tumor of the stomach or intestine (vascular); and (3) the possibility of a portal obstruction. Against the ulcer diagnosis we had to weigh the absence of all gastric symptoms and the absence of all dyspepsia. Against the portal obstruction stood the fact that there was no evidence in the abdominal wall or about the rectum of such obstruction, so that by exclusion we were forced to think the condition was most likely due to a vascular tumor, i.e., polyp or papilloma.

September 23, 1914, the following operation was performed:

Exploratory laparotomy for gastro-intestinal hæmorrhages. Duodeno-jejunostomy and exclusion of duodeno-jejunal junction and upper foot of jejunum for angioma (racemose) of upper jejunum (Dr. Beer). Through a four to five inch upper right rectus incision the upper abdomen was explored. There was no sign of undue congestion in the portal system and there were no glands at the portal fissure. The liver, right kidney, stomach, duodenum, and head of the pancreas, as well as the right half of the colon, were absolutely normal. The colon was turned up to expose the small intestines, which were spastically contracted and negative up to within six inches of the fossa of Treitz, where the jejunum suddenly became red in color due to the injection of a large number of minute vessels. After separating adhesions which bound this diseased part of the jejunum to the transverse mesocolon, it was seen that the whole surface of the upper three to four inches of the jejunum was covered with dilated vessels,

[1] Virchow's Archiv., f. path. Anat.. etc., Berlin, vol. clxxxiv.

[2] Johns Hopkins Bulletin, 1906.

Fig. 1. Shows incision in posterior parietal peritoneum held open exposing duodenum, its stoma, and excluding ligature. To the other side of the mesocolon is the vascular tumor, looking like an enormous conglomerate of vessels involving the upper three to four inches of jejunum.

many of which were fully one-eighth to one-tenth inch in diameter and projected over the level of the adjacent jejunal wall (Fig. I). As this vascular tumor extended up to the duodeno-jejunal junction, a resection was impossible. An attempt to tie off the more prominent vessels did not seem practicable, and after passing one silk ligature about one of the largest vessels no further attempt was made. It was therefore determined to expose the third portion of the duodenum retroperitoneally and exclude the duodeno-jejunal junction and adjacent tumor-bearing area, and then do a duodeno-jejunal anastomosis.

The peritoneum over the third part of the duodenum was cut through and a circular exclusion silk ligature was passed about it after pushing the pancreas out of the way. The furrow made by tying this ligature (loosely) was buried by two layers of sutures, the second layer bringing the cut posterior parietal peritoneum into approximation with the first layer of sutures; then a typical clamp suture anastomosis between the mobilized second part of the duodenum down to the bend into the third part and a part of the jejunum about one foot from the duodeno-jejunal junction was made in an isoperistaltic direction. In making this anastomosis, every advantage was taken of using the jejunal serosa to cement the union, as the duodenum had no peritoneal covering.

While these operative procedures were going on, it was evident that the tumor was bleeding, as the gut filled up under our eyes and became distended with soft clots.

Wound closed in layers, small rubber-dam drain being left in center of wound down to the duodenum.

After the operation the patient vomited several ounces at a time, and repeatedly. She also complained of cramps in the epigastrium. Obstructive symptoms disappeared as soon as the rubber-dam drainage was removed. By the fifteenth day she was walking on the roof, feeling very well. On the sixteenth day, there was a sudden change, the patient becoming weak again, blood appearing by rectum, and within the next twenty-four hours, one massive hæmorrhage having followed another, the patient died.

Epicrisis. It is evident from this experience that an effective anastomosis between the retroperitoneal duodenum and jejunum can be made by suture, and with the conditions presented by this case it is apparent that such an anastomosis, combined with an exclusion of the uppermost jejunal loop, was the only procedure that promised any result.

A SIMPLE AND SATISFACTORY CLOSED ETHER APPARATUS

By L. G. BOWERS, M.D., F.A.C.S., Dayton, Ohio, and L. F. ROSS, M.D., Richmond, Indiana

THE separate parts of the apparatus are shown in Fig. 1 and consist of the rubber bell of the so-called "plumbers' friend" (*a*), a No. 3 soft rubber English ice-bag (*b*), and one piece of an ordinary nickel-plated brass trap such as is used in lavatories (*d*). The rubber bell is easily cut with a safety-razor blade held in a hæmostat, to fit over the nose (Fig. 2, *e*). For many faces a curve must be cut opposite the nose notch to fit over the chin (Fig. 2, *f*). The bell is easily cut down to fit a child's face, as shown in Fig. 2, *e*. The short arm of the trap ends in a flange over which the neck of the ice-bag is slipped and held in place by a rubber band. Several inches of the long arm of the trap should be sawed off, as they come longer than is convenient for use. This plain end is slipped into the socket intended for the handle of the "plumbers' friend" after the disc separating the socket from the lower cone-shaped portion has been cut out. The one and one-fourth inch trap and the rubber bell can be had at a plumbing shop and the ice-bag at a drug-store. In case a proper-sized trap is not available, a piece of iron pipe fitted with a return bed, as shown in Fig. 1, *c*, will answer the purpose. Rubber bells with a smooth inside surface are preferable to those reinforced by projecting ridges on the inside.

Two methods of admitting air to the apparatus have been used. Two small holes may be punched in the rubber bell, as shown in Fig. 2, *f*. These are partly or completely covered by the fingers of the anæsthetist, to regulate the amount of air. The other method is to make a collar from a piece of brass tubing that will fit the pipe snugly just above the bell. Two holes are drilled through the collar and pipe, as shown in Fig. 2, *e*, so that by rotating the collar the openings are partly or completely closed, just as the air is regulated in an ordinary Bunsen burner. This method is much more convenient.

The bell must fit the face closely enough to exclude the air in order to manage the anæsthesia properly, and it is therefore desirable to have on hand several bells with different sizes and shapes of nose openings in order to fit the face accurately. An extra uncut bell should be on hand so that it may be cut to fit the patient in case none already cut fits properly.

In use, six ounces of ether is poured into the bag through the bell, and the apparatus is gradually lowered and carefully adjusted to the patient's face to exclude all air. The air holes are left open, the first two or three minutes, and then gradually closed and kept closed unless the patient becomes slightly cyanotic, in which event they are opened until proper color returns to the face. A very important point to be observed is that the mask must not be removed at all or very rarely to

Fig. 1. *a*, rubber bell; *b*, ice-bag; *c*, iron pipe fitted with a return bed; *d*, nickel-plated brass trap.

Fig. 2. *e*, Rubber bell; *f*, showing curve cut in rubber bell.

wipe the patient's mouth, etc., for so much air is thus admitted that perfect anæsthesia cannot be maintained. Failure to observe this caution in the beginning may make it difficult or impossible to secure complete anæsthesia.

The advantages of the method are —

1. The very small amount of ether used — an average abdominal operation requiring four ounces or less. This greatly reduces the nausea and shock to the patient, and saves waste of ether.

2. Only warm ether vapor is given the patient after the first few minutes, as, by the time the patient is "under," the ether vapor has been warmed by the expired air. The warm vapor is much less likely to produce a pneumonia or bronchitis than is the cold vapor of the open method.

3. The high concentration of ether vapor possible with the air vents closed enables one to take the patient rapidly through the excitement and vomiting stages, and complete surgical anæsthesia is reached in a much shorter time than by the open method.

4. Advantage is taken of the stimulating effect of carbon dioxide on the respiratory center, but cyanosis is readily controlled by use of air vents.

5. The operating room is not filled with ether vapor as by the open method.

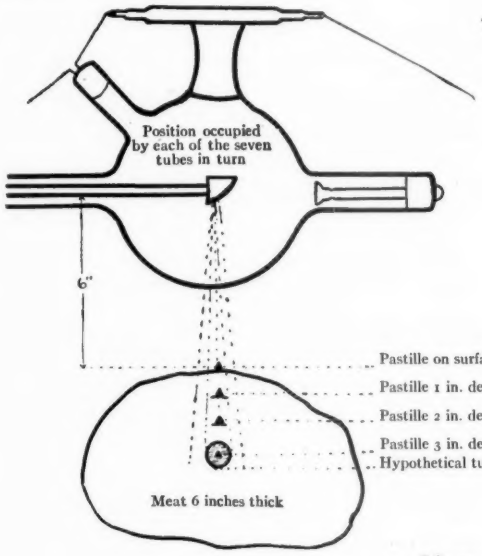
6. The apparatus is cheap, sterilizable, portable, and has no complicated parts to get out of order.

TECHNIQUE AND EXPERIMENTAL APPLICATION OF HARD RAYS FOR DEEP RÖNTGENTHERAPY

By LEWIS GREGORY COLE, M.D., New York

ABOUT a year ago I made some tests comparing the therapeutic efficiency of the Coolidge tube with the standard X-ray tube, the results of which were published in the November *Review of Reviews*.[1] Recently I have repeated these tests, particularly those referring to the quantity of the rays which penetrate three inches below the surface compared with those delivered at the surface. These recent tests check up so closely with the ones made a year ago that I shall refer to the diagrams illustrating my

[1] Med. Rev. of Revs., 1914, Nov.


Position occupied by each of the seven tubes in turn
6"
Pastille on surface
Pastille 1 in. deep
Pastille 2 in. deep
Pastille 3 in. deep
Hypothetical tumor
Meat 6 inches thick

Tube. No.	Parallel Spark Gap Began at	Dropped to	Milliamperage	Exposure (in minutes)
1	6	3	10—20	½
2	7 —6 —5	—4 —4½	10—15	2
3	7½—6 —5	—4 —4½—5	10—15	2
4	5½—5 —4	—4½—5	12—18	2
5	8 —5½—4½	—4 —3½	10—15—18	2
6	4 —4½—4	—3½	15—15—16	1
7	4½—5 —5¾	—6 —5¾	12—10	2
			average 14	total 11½

Average milliampere minutes: 161

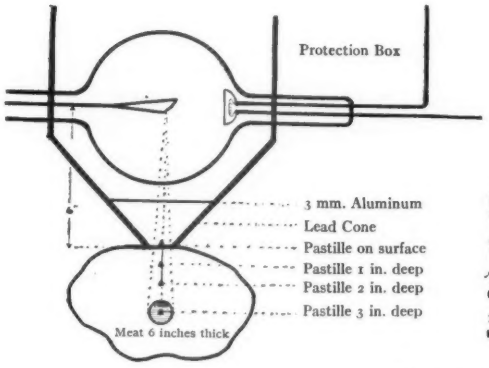
16 times an erythema dose applied to surface

4 times an erythema dose applied 1 in. below surface

Twice an erythema dose applied 2 in. below surface

1 erythema dose applied to tumor

Diagram 1.



Parallel Spark Gap	Milli-amperage	Exposure (minutes)	Hampson Reading
8	10	1	Surface: 4
8	10	1	Surface: 8
8	10	1	Surface: 12
8	10	1	Surface: 16
8	9	1	Surface: 20
8	10	1	(1 in. deep) 15
			(2 in. deep) 8
		Total 6	(3 in. deep) 4

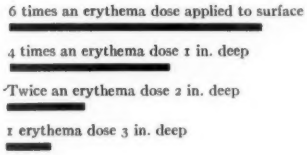

6 times an erythema dose applied to surface
4 times an erythema dose 1 in. deep
Twice an erythema dose 2 in. deep
1 erythema dose 3 in. deep

Diagram 2.

previous communication to demonstrate the points as far as I went at that time.

The advent of the Coolidge tube marked a new era in röntgentherapy. Rays were obtained from this tube that excelled others in penetration, and it could be operated continuously without any fluctuation at a penetration greater than that even temporarily obtained in the standard type of tube.

In order to demonstrate the superiority of the Coolidge tube over the standard type of tubes and to prove that with the Coolidge tube an amount of X-ray equivalent to an erythema dose may be administered to a tumor three inches below the surface without endangering the skin itself or intervening tissues, the following experiments[1] are submitted, showing —

1. That most of the rays from the ordinary tube, operated at its greatest penetration with a standard "transformer," are absorbed in the first inch of the tissue, if no filter be interposed.

2. That with the ordinary tube, operated to its fullest capacity on such an apparatus, no filter being interposed, eleven and one-half minutes are required to obtain an erythema dose three inches below the surface and that sixteen times an erythema dose is meanwhile administered to the skin.

3. That with the Coolidge tube a full erythema dose can be administered to the surface in thirty seconds, if no filter be interposed.

4. That with the Coolidge tube four Hampson units can be applied to the surface in one minute, through three millimeters of aluminum.

5. That with the Coolidge tube a dose of four Hampson units can be obtained three inches below the surface in six minutes through six ports of entry, using a three-millimeter filter.

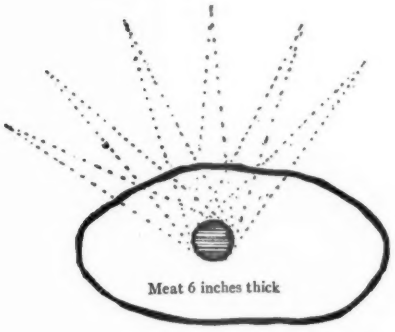
[1] Pfahler advocated and described the use of a filter in 1906.

The experiments undertaken in proof of these tenets consisted of the röntgenization of an area three inches below the surface of a piece of meat six inches thick, a depth of tissue calling for a penetration about equal to that required for treating a cancer of the pylorus or cancer of the uterus. The surface of the meat was six inches from the focal point. The doses were measured by Hampson pastilles, one placed on the surface of the meat, a second imbedded one inch deep, a third located two inches from the surface, and a fourth three inches from the surface.

The first experiment, illustrated in Diagram 1, shows the inefficiency of the X-ray treatment of deep lesions by the ordinary röntgen ray tubes, when neither filters nor the cross-fire method is employed.

Experiment 1. The area three inches from the surface of the meat was exposed to rays from seven ordinary tubes, excited to their greatest capacity by a standard transformer with a parallel gap ranging from seven to four inches; this average being about four and a half to five inches parallel gap, according to the table given on the diagram. Eleven and one-half minutes were required to obtain a ray equal to an erythema dose at the fourth pastille, situated three inches below the surface, the supposed depth from the surface of a cancer of the pylorus. The surface pastille received coincidentally sixteen times an erythema dose—an exposure which of course would have burned a patient beyond recovery.

If not more than an erythema dose had been administered on the skin, only one-sixteenth dose would have reached the tumor three inches deep, an amount of ray so small that it would not have any beneficial effect and might even stimulate the growth. The accompanying diagram (Diagram



Cross-fire method, using 6 ports of entry:

A series of 6 exposures of 1 min. each, made with the tube at 6 different angles, 6 ins. distant from the skin.

Result: Surface area as well as tumor receives approximately only 1 erythema dose.

Diagram 3.

1) shows the position of the tube and pastilles, and includes a comparative table of the doses administered on the surface, and one, two, and three inches below the surface.

Experiment 2, illustrated in Diagram 2, indicates the wonderful possibilities of the highly penetrating rays from the Coolidge tube, filtered adequately, and administered through six ports of entry by the cross-fire method. In this test one Coolidge tube was used, operated at a high penetration by a standard four-KW transformer, according to the table on the diagram. The soft rays were filtered out with three millimeters of aluminum. Six exposures of one minute each were sufficient to obtain a dose three inches below the surface. The use of six ports of entry eliminates the danger of burning the skin so that each surface area receives only one erythema dose. As our experiments were made on a piece of meat this precaution was uncalled for (Diagram 3).

These tests were used as a basis for the therapeutical application of the röntgen rays to deep-seated growths, particularly malignant growths.

By gradually increasing the quantity of these highly penetrating rays, which had been filtered through three millimeters of aluminum, I found that from three to four times the standard erythema dose of four Hampson units could be applied to the surface, but it must be borne in mind that this applied only to the highly penetrating rays filtered through three millimeters of aluminum. I use the Saboreaud pastille and the Hampson scale for reading, and for the first series of treatments I give twelve Hampson units to blonds and fourteen to sixteen to brunettes.

This is obtained uniformly by the following technique:

The tube is placed in a specially constructed box, as shown in Diagram 5. It is cooled by a blast of air from an electric blower and the air is forced out from each terminal to keep those cool. The anterior hemisphere of the tube projects down into the large end of a short lead cone and the small end of the cone is directed toward the growth to be treated.

The small end of the cone is placed about one inch from the surface of the body. In order to prevent the static current from snapping down upon the patient a small piece of lead-impregnated rubber with a square hole the size of the small end of the cone is placed on the surface of the skin, and the position of the hole, that is, the area to be treated, is marked on the skin with indelible pencil.

Different ports of entry are obtained by changing the position of the tube or the position of the patient above the diaphragm. For pelvic lesions from six to ten abdominal ports of entry are used, and sometimes I have used from two to six posterior ports of entry; but except for the two lower ones I have little confidence in the posterior exposures on account of the intervention of the bony pelvis.

Theoretically, the ray diminishes as the square of the distance from its source; therefore, an object six inches from the focal point receives more than twice the quantity of rays that one at nine inches receives, even though no solid substance is interposed. A growth three inches below the surface would thus receive only about one-half that on the surface even if the intervening tissues were not present.

Tests with pastilles corroborated this. A fresh pastille was cut in two, and one-half placed six inches from the focal point, and the other nine inches from the focal point without any solid being interposed. An exposure of four minutes, ten milliampere circuit, eight inches parallel gap, gave a reading of sixteen Hampson

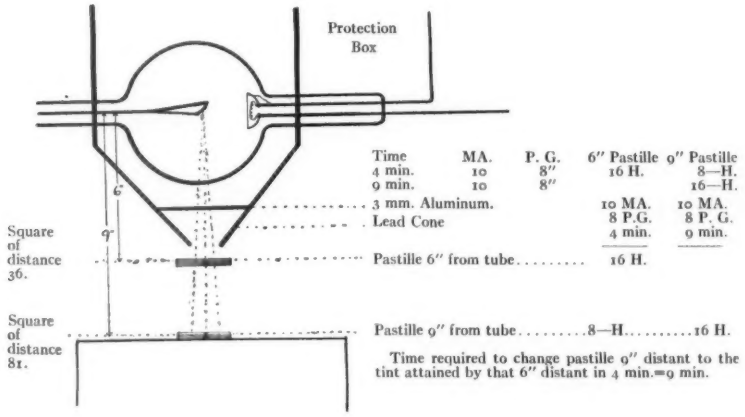

Protection Box
6"
9"
Square of distance 36.
Square of distance 81.
Time MA. P. G. 6" Pastille 9" Pastille
4 min. 10 8" 16 H. 8—H.
9 min. 10 8" 16—H.
3 mm. Aluminum. 10 MA. 10 MA.
Lead Cone 8 P.G. 8 P. G.
4 min. 9 min.
Pastille 6" from tube..... 16 H.
Pastille 9" from tube.....8—H.....16 H.
Time required to change pastille 9" distant to the tint attained by that 6" distant in 4 min.=9 min.

Diagram 4.

units on the one six inches from the focal point, and eight Hampson units on the one nine inches from the focal point. In order to prove this and make it more accurate the pastille which was nine inches from the focal point was replaced; the exposure was continued, and it required five minutes more or nine minutes in all to change the color of that half of the pastille to a tint corresponding to that of the pastille which had received four minutes' treatment at six inches (Diagram 4).

Another similar test was made, using the same distance, spark gap, milliamperes, and time, but a cake of paraffin three inches thick was interposed between the two pastilles. Paraffin was used because it is a little less dense than muscle so that it corresponds to the average density of the tissue interposed between a deep-seated tumor and the surface of the body (Diagram 5).

The pastille on the surface of the paraffin six inches from the focal point received sixteen Hampson units and the one beneath the paraffin, nine inches from the focal point, read 4+ instead of 8— as it would have read had the paraffin not been interposed, and it required a total of fifteen minutes to change the color of the pastille

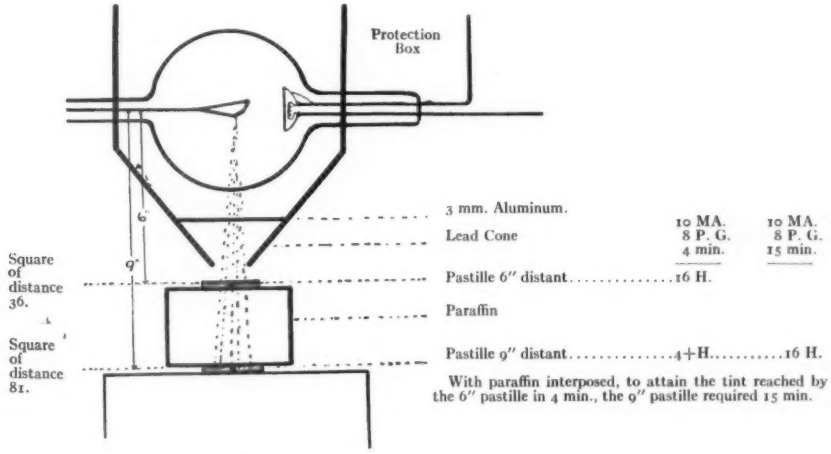

Protection Box
6"
9"
Square of distance 36.
Square of distance 81.
3 mm. Aluminum.
Lead Cone 10 MA. 8 P. G. 4 min. 10 MA. 8 P. G. 15 min.
Pastille 6" distant.....16 H.
Paraffin
Pastille 9" distant.....4+H.....16 H.
With paraffin interposed, to attain the tint reached by the 6" pastille in 4 min., the 9" pastille required 15 min.

Diagram 5.

beneath the three inches of paraffin and nine inches from the focal point to the same tint rendered to the one on the surface in four minutes.

Comparing these tests with those described in the previous communication where a piece of solid muscle was used instead of paraffin one notes that in order to obtain an erythema dose three inches below the surface from four to six times that amount (depending on whether fat or muscle is interposed) must be applied to the surface.

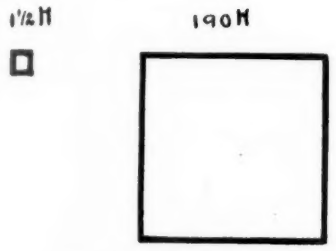
Tests concerning the burning qualities of filtered and unfiltered rays brought out the following conclusions:

An amount of unscreened X-ray necessary to change the pastilles from zero to four on the Hampson scale is considered an erythema dose and six Hampson units is considered the limit of safety. If, however, a ray of high penetration emanating from a tube backing up eight inches parallel gap is screened by three millimeters of aluminum far more than four or six Hampson units may be safely applied to the skin.

In the treatment of desperate cases of cancer which were bound to die, I increased the amount of the highly penetrating *screened* ray until I was giving twelve to sixteen Hampson units, or three to four times the standard erythema dose through each port of entry. When these tremendous doses are given, care must be observed that the areas do not overlap, and scar tissue should be protected from getting the full force of the ray.

In one case which had been diagnosed as mediastinal sarcoma I gave twenty treatments through twenty ports of entry, each one being three and a half inches square on the surface. Each treatment was given with an eight-inch parallel gap, ten milliampere circuit, six inches distant from the skin, four minutes' time, dose twelve to sixteen Hampson units.

With the old type of tube and without filter or cross fire, six Hampson units was about the limit that could be applied to the skin. If this were directed toward a tumor three inches below the surface only about one-sixteenth of the energy would reach the tumor; therefore the tumor would receive about three-eights of one Hampson unit.



Showing relative amount of X-R applied to tumor mass by the unfiltered single port method and by the highly filtered cross-fire method.

Diagram 6.

Now with this mediastinal tumor twelve to sixteen (fourteen average) Hampson units were applied to the surface every day except Sunday. One-fourth of that or an average of three and one-half Hampson units was applied to the growth itself at each treatment and twenty ports of entry were employed for each series; therefore, three and one-half times twenty or seventy Hampson units were applied during the first series and by the time the first series was completed the skin over the area first treated had so far recovered that we repeated the procedure, beginning the second series within ten days after the first series ceased. With each dose of this series about twelve Hampson units were applied to the skin and about three Hampson units reached the tumor mass. Twenty more exposures were given, making sixty Hampson units, or a total of one hundred thirty Hampson units applied to the tumor itself, more than one hundred fifty times the amount that could have been applied without the high penetration rendered possible by the Coolidge tube, the screen, and cross-fire method of exposure.

Two months later a third series of twenty treatments was given, making a total of one hundred ninety Hampson units applied to the tumor mass as compared with about one or one and one-half Hampson units that could have been applied to them with the standard tubes without the screen or cross fire (Diagram 6).

INTERSIGMOID RETROPERITONEAL HERNIA

By J. C. BLACK, M.D., Regina, Saskatchewan

An intersigmoid retroperitoneal hernia is one of the rarest of all forms of hernia; so much so that J. B. Murphy, in the August (1914) number of the *Clinics*, reports a case and says that Moynihan claims that there are only two other cases reported in the entire medical literature previous to his. I thought that this case would prove interesting to the profession inasmuch as a tentative diagnosis was made before the operation—which is unusual, as these cases are generally diagnosed only at operation when strangulation has occurred. The patient, being a very intelligent person and having formerly been a nurse, was able to state her symptoms clearly and so aided very materially in making the diagnosis.

The main features about the symptoms were first the history of a fall, immediately followed by a pain in the lumbar region of the spine and in the left iliac region. This was followed by constipation and inability to assume the left prone position or do much walking, but she could lie with perfect comfort on the right side. This would be explained by the fact that a coil of intestine would enter the hernia while walking or lying on the left side and so cause pain, which would be relieved after lying on the right side for a time, as the intestine would then slip out of the hernia.

The patient was a married woman, aged 34 years. A little over two years ago, when about seven months pregnant, the patient slipped and fell on the sidewalk, alighting squarely on the buttocks. She was immediately seized with a sharp pain in the back which radiated into the left iliac region. This pain continued throughout the remainder of pregnancy, which terminated at the end of the eighth month with a normal delivery, and a feeble male child was born which only survived its birth eight hours.

On the fifth day of the puerperium the patient's left leg swelled and she was seized with violent pains which radiated from the leg to the left iliac and lumbar region of the spine. This continued for about a month, and during this time the temperature remained practically normal, and only on two different days did it go to 100°. At one time, when the swelling was great, we were undecided as to whether fluctuation was present or not, and a tentative diagnosis of psoas abscess was made. Finally this all cleared up and the patient gained weight, but the pain in the lumbar region of the spine and in the iliac region continued. Tenderness also was present at a point about midway between the left anterior superior spine and the umbilicus, but no tumor was ever felt. The patient also noticed that she was unable to lie on the left side, as the pain was thus increased; walking also increased this pain. Constipation was another marked symptom; purgatives at times were useless, but an enema would generally relieve the distress.

After suffering with these symptoms for about six months the patient went to a hospital, and returned with a diagnosis of sciatica due to phlebitis following pregnancy. X-ray pictures were taken and no sign of any involvement of the spine could be made out, so that psoas was ruled out of the diagnosis.

After returning home the patient still had the symptoms and had not recovered from the lumbar and iliac pain, as she had been led at the hospital to expect. I was again consulted about the beginning of December, 1914. At this time constipation was very severe, and the pain at times was excruciating, so that the patient was kept awake all night and was unable to attend to her household duties. An enema would often relieve the symptoms for a time, but on assuming the left reclining or upright posture, the pain immediately began again. The probability of a hernia into the sigmoid mesentery was explained to her, an operation advised and performed on December 8, 1914.

A small hernia between the two peritoneal layers of the mesentery of the sigmoid was found. The hernia would just admit two fingers, and was about one and one-half to two inches deep, and was situated about two inches from the root of the right side of the mesentery. The peritoneum lining this cavity was dissected out, and the opening was closed with silk thread. The appendix was removed and the abdomen closed. Recovery was uneventful, except for considerable vomiting—which was controlled by stomach lavage—and a small hæmatoma which developed in the rectus as a result of the vomiting, but which subsequently subsided.

INTRA-ABDOMINAL USE OF OXYGEN

By G. KIRBY COLLIER, M.D., F.A.C.S., Sonyea, New York

THE use of oxygen intra-abdominally following surgical procedures was, we believe, first introduced in America by Dr. William Seaman Bainbridge of New York. While attending the Clinical Congress of Surgeons of North America in New York City in November, 1912, it was my good fortune to see a number of abdominal operations performed by Dr. Bainbridge in the greater number of which oxygen was used intra-abdominally.

We followed one of his patients to the ward, and noting the very rapid recovery from the anæsthetic and the apparent absence of shock, we decided to try this procedure in a series of cases.

Its technique is most simple: The ordinary tank of oxygen with its wash-bottles, as is found in every operating room, a length of rubber tubing and glass tubing, are the only appliances necessary for the procedure. The rubber tubing is attached to the wash-bottle through which the oxygen passes, and a few feet from the wash-bottle a rubber coil, placed in a basin of hot water to keep the oxygen at a temperature of 100°F, or thereabouts, is attached. To the end of this coil is attached sterile glass tubing with the proper angulation to permit of introduction into the abdominal cavity and to prevent interference with the proper closure of the wound. Before the closure of the peritoneum is completed, this glass tube is introduced, being sewed tightly into the wound. Then the remaining layers of the abdominal wall are closed in the usual manner, the glass tube still remaining in position. During the entire time oxygen is allowed to pass in slowly. After the complete closure of the abdominal wound, the oxygen is continued until there is a very considerable distention of the abdomen, when the tube is gently removed, the small opening left, quickly closing and not permitting of the escape of any of the oxygen. This procedure is very simple and requires no extra time, as the sterile glass tube to be introduced into the abdomen lies on the instrument table, and the connection is readily being made by one of the nurses while the surgeon closes the abdominal wound.

We have now used oxygen intra-abdominally in twenty-five laparotomies, and the results have been most favorable in all.

The lessening of shock, the absence of nausea and vomiting, and the early recovery from the anæsthetic have been the most marked features of its use, and we have not in any case seen any untoward effects.

The absorption of the oxygen is quite rapid, and even though there might be some apparent embarassment of the respiration due to overdistention of the abdomen, we have never felt that this was an element of fear, owing to the rapid absorption of the gas.

The distressing post-operative results, so often seen, have been eliminated in those cases in which oxygen has been used, and we believe there will be a more widespread use of this valuable adjunct of the surgeon.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING WAS HELD APRIL 16, 1915, WITH THE PRESIDENT, DR. ROBERT T. GILLMORE, IN THE CHAIR

RETROCÆCAL TUMOR IN THE MALE

DR. ROBERT T. GILLMORE: This patient, Mr. W. L., is married, 37 years of age, and occupies a position as sales manager. When I first saw him he complained of a dull pain, across the lower part of the abdomen, which had existed since October, 1914, and was accompanied with nausea. On October 14, 1914, two hours after eating fruit, including grapes, he suffered with severe, sharp, piercing pains across the upper part of the abdomen. These pains were colicky in nature, lasting one-half minute at a time, and were about 15 minutes apart. He vomited a number of grape seeds. A movement of the bowels did not relieve him. There was no blood in the stool. About this time the patient noticed a hard mass, the size of an egg, in McBurney's point. This mass remained stationary until within a few weeks of the time I saw him, when it began suddenly to enlarge. February 20, 1915, the patient suffered with a heavy sensation which was suggestive of a "strong" pain. At that time he was in Sacramento, California, and consulted a physician who diagnosed sarcoma and advised him to go home immediately. The following day his pain and nausea were more marked. The patient always has been inclined to loose bowels and this condition was not modified with his indisposition.

There is a history of mumps and measles during childhood. The patient has had gonorrhœa twice. In 1904 he had a venereal wart on the back of the foreskin and small sores on the face. At this time he received an injection of "circinophyl"—a quack medicine—and there was a temporary improvement.

His mother died at the age of 64, of pneumonia. His father is living and well. There is no family history which will throw any light on the patient's present condition. The patient is temperate in alcohol, although an inveterate smoker. He does not drink tea or coffee. His skin is clear. There is no œdema. His pupils are equal, regular, and react normally to light. He presents a slight pharyngitis. The chest, heart, and blood-vessels are normal.

On abdominal palpation there is marked bulging below the umbilicus, which is more pronounced on the right side. The tumor is as large as a medium-sized muskmelon and occupies the right lower quadrant, from the umbilicus, extending three inches to the left of the median line. There is tenderness over the tumor. The patient has lost about twenty pounds. Urinary analysis was negative.

Dr. Robert Preble saw the patient in consultation and suggested an X-ray in order to determine the diagnosis. The picture of the bismuth-lined intestine showed it somewhat dilated, apparently lying above the tumor.

Diagnosis. The clinical findings were suggestive of sarcoma, or some malignant growth.

Operation. An incision was made over McBurney's point and a large, hard retrocæcal tumor was disclosed which seemed to be attached to the head of the cæcum. The appendix was found without mesentery, lying flattened over the top of the tumor. The pathological finding was that of a myxofibroma. One of the small tumors on his face was removed with negative findings as to malignancy. One of the glands behind the tumor was taken out for laboratory examination, and the pathologist reported that there was no malignancy.

The patient made an uneventful recovery and has been steadily gaining in strength and weight.

DR. T. J. DOEDERLEIN: I am quite interested in this case because the man is a neighbor of mine. His wife told me about these tumors he had on the face and I saw them, after they were removed, in a glass. She had a number of them in alcohol. She claims he went to a specialist, either in Boston or Philadelphia, who told her it was a cancer. He injected arsenic or some solution of arsenic. When I heard that he had this enormous tumor of the cæcum I thought it might be a sarcoma, but I am pleased

to know it is not a sarcoma, although the clinical history was very suspicious to me.

UNRUPTURED EXTRA-UTERINE PREGNANCY, OR TUBAL ABORTION

Dr. Rudolph W. Holmes: The report of an extra-uterine pregnancy is of no particular interest as so frequently they are being recognized and reported, but unruptured tubal pregnancy is still relatively rarely recognized. In medical societies it has been repeatedly said that extra-uterine pregnancy should be recognized before rupture. I believe this is too sweeping a statement. Two reasons militate against the early diagnosis: The pregnant woman, as a rule, does not visit a physician until pregnancy has advanced some weeks or months, and this is usually beyond the period when an ectopic pregnancy causes trouble. Even granted a woman should visit her physician when she has missed her first period, conditions must be peculiarly favorable to palpate the slightly enlarged tubal pregnancy. Ordinarily, the woman calls her medical attendant when she suspects something wrong, the suspicion being aroused by pain, uterine bleeding, or both. If with this she has an intratubal hæmorrhage, the swelling may be sufficient to enlarge the tube so it may be palpable. This stage may be called that of tubal abortion. If allowed to continue, later, she will have an actual tubal rupture.

It happens that I have had but two extra-uterine pregnancies in my own personal private practice, and in both instances I was able to recognize them before rupture of the tube took place.

The patient menstruated February 4, and I saw her first on March 26. Three days previously she had abdominal colic, faintness, and spotting of blood. At that time a gynecologist examined her, suspected a possible extra-uterine pregnancy, or perhaps, a threatened abortion. When I saw her on the 26th she had a slight recurrence of previous symptoms. To the left of the uterus was a soft sausage-shaped swelling of the tube—there was at least an inch between the uterus and the swelling. On opening the abdomen, I found a very slight bloody discharge in the pelvis, hardly a dram, showing that there had been an attempt at tubal abortion. The tube alone was removed. At the same time her appendix was removed, and she recovered without any untoward symptoms.

Dr. Curtis: I would like to ask Dr. Holmes whether any peculiarity appeared in the structure of the ovary?

Dr. Holmes: The left ovary contained the corpus luteum.

Dr. N. Sproat Heaney: There is a little confusion in my mind just what is to be understood by unruptured ectopic pregnancy. This patient fainted after an attack of pain, and something happened to the ovum. I wonder if we should understand by an unruptured ectopic gestation only that the tubal wall is not split.

Dr. Holmes: That is what I would have you understand in this case.

Dr. Heaney: We understand that an unruptured ectopic is a rare affair, while we know tubal abortion is not at all infrequent. The ovum will be dislocated, will be aborted into the abdomen, with no actual tearing of the tubal fiber. It is not technically a ruptured ectopic yet has all the symptoms of such. I think the ovum here presented was dislocated from its original site, and while it is true that the tubal wall is not ruptured in this case, it should not be called an unruptured ectopic—a rare case—but a tubal abortion not yet completed. The term unruptured ectopic should be synonymous with undisturbed ectopic.

Dr. Holmes: The fact which I wished to have understood was that the tube had not ruptured. As to whether or not there had been a dislodgment of the ovum from its site of imbedding can only be told by sectioning the tube. There is a close analogy between a threatened intra-uterine abortion and tubal abortion; in each a chorionic separation may occur to a slight degree, and with the subsidence of symptoms ovular growth may continue. Or if the separation is great enough ovular death may and will occur. Undoubtedly, frequently the earlier symptoms of actual tubal rupture are due to attempts at tubal abortion. However, practically all the extra-uterine gestations I have had, have presented gross tubal lesions, with much free blood in the abdomen, because they came to me late. In the case presented, a good gynecologist examined the patient on Tuesday, and found nothing. I examined her on Friday and found a distinct tubal tumor. The increased size, making palpation possible, undoubtedly was due to distention from retained blood. Later, there may be no question that she would have had the classical ruptured ectopic.

Dr. Charles E. Paddock: It has just occurred to me that a case which I have recently had might be of some interest and worth a report.

Mrs. X., II-para, missed a period on June 1, 1914. June 23 there was a slight blood dis-

charge and three days later she passed what proved to be the amnion, in which could be seen a beginning embryo, the sac not measuring more than 1 cm. in diameter. There was no decidual discharge as far as could be discovered, and in three or four days all lochia had ceased.

Nausea was quite pronounced about August 1, and the patient insisted she was still pregnant. On September 15 an examination showed the uterus enlarged to about a ten-weeks' pregnancy, and on March 20, 1915, the patient was delivered of a child which was full if not past term. Whether this started as a twin pregnancy or that conception occurred immediately after the abortion cannot be answered. There is a history of coitus one week after the abortion.

The question is often asked how soon after a labor is it possible for one to become pregnant, and I presume it is safe to answer, one may become pregnant at any time.

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD APRIL 2, 1915, WITH DR. D. W. GRAHAM IN THE CHAIR

THROMBO-ANGIITIS OBLITERANS

DR. VICTOR L. SCHRAGER: I want to show you a group of cases of a disease which is not very rare, but the true nature of which is not recognized until the last stage of the disease. There have been a number of such cases at the Mount Sinai Hospital, New York, and the disease has been termed by Leo Buerger thrombo-angiitis obliterans. It is a presenile gangrene, and, from the symptoms manifested, the cases are ordinarily classified as rheumatism and flat-foot. In one of the best hospitals in Chicago a case was treated for gonorrhœal rheumatism because the patient had a coincident Neisserian infection. During the first four months two cases were treated for rheumatism and flat-foot.

One patient, a girl, had a sudden attack of violent pain in the foot, without any warning, and subsequently she developed stiffness in the toes. She has had alternating periods of extreme pain in the toes. The condition of the toes improved, but later, when frightened by a horse, there was a sudden pallor of the foot, and the toes were absolutely cold. This girl has had three attacks of intermittent claudication which lasted from a few minutes to a few hours.

The next case is that of a man who has had similar symptoms, with a history of cold and pallor of the toes, severe pain, and subsequently gangrene. He had lost three toes on one foot. He is thirty-five years of age.

In three of the cases the disease started fifteen years ago and all presented very much the same clinical picture. It begins with redness pain, the formation of a blister, and then terminates in gangrene.

There has been a great deal of discussion in the literature as to the etiology of this disease. Oppenheim considers it a congenital anomaly of the blood-vessels, with abnormal smallness of their lumina. He also thinks that nicotine poisoning has a great deal to do with the gangrene. The best studies of this disease have been made at Mount Sinai Hospital, New York, by Buerger, where they have had seventy-five cases. No plausible theory is offered as to the cause, but Buerger is of the opinion that the condition is not similar to arteriosclerosis, or ordinary endarteritis, the gangrene being the result of a progressive occlusion of the vessel by a thrombus.

When we are confronted by cases of this kind, nothing short of amputation will do any good. Sometimes even an amputation high up for simple gangrene of a toe will not be of much service. I recall the case of a farmer who had a black toe for six or seven months. The toe was completely gangrenous, so I advised him that an amputation of the leg was necessary. He was much frightened, but finally accepted the situation. I amputated at the upper third of the tibia, but the flap did not bleed. The patient developed gas-bacillus infection and died.

Dr. Buerger reports one case in which an arterial anastomosis was done for the relief of this condition. There is also one case reported from Constantinople in which this operation was done.

My object in showing these cases is to emphasize the possibility of early presenile gangrene in cases of pain in the foot and redness of the toes. When you see such a condition and there is no pulsation of vessels, nothing short of amputation will save the patient.

None of these cases has a high blood pressure. On the contrary they have a low blood pressure; but that does not exclude the possibility of arteriosclerosis. Bouchard has shown that a great many cases of advanced arteriosclerosis have a low blood pressure.

HYDROCEPHALUS

DR. L. L. MCARTHUR: A month ago I did an operation at a clinic which was given for our guests on that day, and at the suggestion of Dr. Willy

Meyer, who was much interested in it, I have had the patient brought here to show the result four weeks after operation.

Four weeks ago this child was operated on at St. Luke's Hospital for a very pronounced hydrocephalus. The operative interference was made necessary by the baggy condition of the head, the bulging eyes, and bulging fontanelle, showing that the child was rapidly going to pot with the typical symptoms of hydrocephalus. There was a passage way between the spinal canal and the cranial cavity. A spinal puncture to reduce the tension in the fontanelle secured prompt reduction, showing that there was something to be gained if we could establish a channel between the interior of the ventricles and the outer surface of the brain, because the fluid on the surface of the brain could be emptied into the spinal canal, and equilibrium established in that way.

The procedure undertaken was that which has been recommended by Anton, and in this particular case it proved peculiarly efficacious. Instead of a bulging fontanelle, we have now a normal fontanelle which is rapidly closing in. The whole skull, instead of being baggy, is settling, and the fontanelle, instead of bulging out, is really depressed. The technique employed is simple for a cranial operation. An opening is made about a centimeter and a half posterior to the junction of the coronal suture; with the longitudinal suture, a small flap is turned back, and at one-half to three-quarters of a centimeter from the middle line a small opening is made in the dura to avoid the large median vein. Then, with a small ureteral silver catheter with multiple perforations on the side of it, or with a special instrument similar to the one that Anton devised (I used a silver ureteral catheter), one pushes the instrument, with its point in contact with the falx cerebri, down to the corpus callosum. This offers a delicate resistance, but with a little pressure the instrument enters the lateral ventricle and the water begins to flow. After an amount of fluid is allowed to escape from the ventricle, a slight sweeping motion is made to tear a permanent hole in the roof of the ventricle to allow escape to the subarachnoidian space. If there be a free connection with the spinal canal, the patient is apt to be benefited. The child upon whom the operation was done is fifteen months old, and is now able to sit up, calls for food, and is quite observant.

This procedure is about the best form of decompression that can be done in cases of tumor if one can determine on which side the greater amount of pressure is. With an instrument introduced into the ventricle, one secures a considerable quantity of effusion when there is a cerebral tumor. Provision is made for the escape of the fluid. In this way it makes a decompression to exceed temporal decompression, and symptoms sometimes will make it possible to localize a cerebral tumor which otherwise would not be revealed. In this case there was no bone, but simply soft cartilaginous membrane.

CARCINOMA OF THE RECTUM

Eighteen days ago I removed a carcinoma of the rectum in this patient. It was a rectal carcinoma in the sense that it was very extensive, extending from an inch and a half within the sphincter to well beyond any possible reach of the finger. The preliminary operation which had been done revealed extensive glandular infiltration in the mediosacral region, which made it necessary to do a wide resection. At the preliminary operation was made the artificial anus to which I desire to call your attention.

First, there is the median incision for the purpose of determining whether a temporary or artificial anus shall be made. Second, having determined what shall be done, before interfering with the bowel, an incision is made in the usual position for removal of the appendix, but on the left side and so situated that it shall lie close to and well below the anterior superior spine; then, having a loop brought through, a cutaneous incision is made between the anterior superior spine and the anterior inferior spine but a little external to it, because there is a bony background between these spines against which a large belt may be worn with a pad on it.

When one introduces the finger into such a fistulous tract, there is found a receptacle in the abdominal wall external to the muscles, but beneath the skin, which with the bony background can be compressed. With a flushing in the morning the bowel can then be left for the day without further treatment. We did not make absolute control because we have not yet completed the final stage of the operation, which is to remove the excess of mucosa, which I think is desirable to have until adhesions have taken place. We draw the bowel through an inch or more, let the adhesions form, and later remove the excess of mucosa and bowel-wall. This will be done with cocaine anæsthesia, flush with the skin, and we will have a normal anal margin with mucocutaneous junction. In this case there were seven inches of bowel resected because the sacral glands were involved, necessitating a Kraske operation.

In the removal of a carcinoma of the rectum, one sometimes desires to make a temporary artificial anus, or sometimes a permanent artificial anus. For a permanent artificial anus, the bowel is resected and the ends brought out. When you want to make a temporary removal by a spur, I have found a very satisfactory thing is to modify the ordinary glass tube recommended by Madyl by having a bend in it beneath the loop so that the loop of bowel will not be out flush with the skin.

CARCINOMA OF THE CAPUT COLI

I have had this patient come down here tonight because his case illustrates one of those instances in which it is difficult to make a diagnosis, and on that account I thought it would be of interest to present him.

This man presented himself with a chronic appen-

dicitis. He had temperature, he had tenderness, and he had a tumor. He had been seen by Dr. Herrick, who pronounced the case one of carcinoma of the caput coli, and he was referred to me for operative interference. Because he had temperature, pain, and a leucocyte count, and because I had had a similar experience with Dr. Herrick, and because I was right the first time I thought I would be right this time. It was a case in which the appendix was wrapped in the omentum, so that it would move around in the abdomen without any attachment to the anterior abdominal wall and gave one all the characteristics of a movable tumor of the head of the colon. Both of us were right. It was a carcinoma of the caput coli with an appendicitis caused by cancer occlusion, necessitating removal of the caput coli with implantation of the ileum into the transverse colon.

When I finished the operation and began to count the sponges, I was told one was missing. However, in introducing my hand into the bottom of the pelvis I pulled up a mass which proved to be a carcinomatous implantation on a loop of the small intestine. This was resected, and circular suture made with end-to-end implantation of the bowel. The patient has had no distress since the operation.

BONE CYST

This man had a tumor in the lower end of the fibula that was tender and looked vascular, and there was every reason to feel from the elasticity of it and the clinical history that it was a sarcoma of the lower end of the tibia. Before resorting to amputation, removal of some of the growth was advised. Upon opening it there was found a fibrocystic mass which could be shelled out in a solid lump and which proved to be a bone cyst.

The fact that it is a bone cyst is of little interest to you, but I thought it would be of interest to you to know that I closed the cavity immediately, filling it with a chunk of fat taken from the thigh. By dissecting out a piece of fat after the suggestion of Makkas, I was able to effect primary closure, and the man has a good result. It is now four weeks since the operation was done. The large cavity left by curetting such a bone cyst out is an annoyance to a man who has to earn his living; he cannot afford to stay in the hospital a long time; hence it is a matter of financial interest to get him well quickly. In that way one can do it. One should not hesitate in a case of bone cyst to fill in the cavity with Mosetig-Moorhof plug, with Beck's paste, or with any other material that will obliterate the cavity. It is better than the blood-clot that has been so frequently recommended.

CARCINOMA OF THE RECTUM

DR. CARL B. DAVIS: The first case I present, some of you have seen before. I show her as a good example of what may be accomplished by removal of carcinoma of the rectum by the combined operation. This woman was operated upon four years ago, and is still in good condition. The anus is not of the same type as that described by Dr. McArthur, but is controlled to the satisfaction of the patient.

The incision was made through the median line, the bowel brought up through the muscles underneath the skin, and stitched to this point (indicating), so that she has had control of the fæces. The rectum was removed by the Kraske route. She has gained thirty pounds in weight since the operation. One patient on whom I operated has gone seven years without recurrence of the disease.

The next patient was operated upon a year ago. The same operation was done in her case as in the other. She has gained about forty pounds.

In both of these cases there is a loop of colon extending several inches below the level of the artificial anus. The patients flush the accumulated fæces from this loop each morning and as a rule do not have any escape of fæces until the next flushing.

A CASE OF SIMULTANEOUS SARCOMA AND CARCINOMA OF THE FACE

DR. KELLOGG SPEED: The patient is a male, 68 years old, a carpenter. Ten years ago he noticed a small growth on the anterior portion of the right temple. This was hard and reached the size of a walnut three years ago when it was removed. There was recurrence, and removal followed again 6 months before he was seen. In the last three months the tumor has reached the size of a large hen's egg, growing faster than ever before. It is soft, not painful or tender, and is partly movable, evidently not adherent to the skull. It had a bluish red color, was spherical in shape, and the surface was excoriated and covered with crusts.

Behind and below the right ear is a crust-covered ulcerated area in the skin and subcutaneous tissues, the edges of which are reddened and infiltrated. This has been present several years.

The large tumor was moist and bloody on section. Pink color. Microscopically it is made up of a loose network of spindle cells whose nuclei are large, variable in size and shape and stain deeply. Microscopic diagnosis: spindle-cell sarcoma.

The small tumor was grossly an elevated area about the ulcer with indurated edges. After the crust was removed the surface was pink and moist. It cut with slight resistance and microscopic sections demonstrated a lawless overgrowth of epithelial cells suggesting a mildly malignant growth.

Both tumor masses were removed by wide excision. The larger seemed to originate from the superficial layer of the temporal fascia. The temporal muscle and all tissues down to the periosteum were removed. The wound is granulating slowly.

DEATH FROM PYLORIC STENOSIS FOLLOWING THE INGESTION OF HYDROCHLORIC ACID

DR. KELLOGG SPEED: The patient was a male aged 33 years, a brass finisher, who had never been

sick in his life. Two months before consultation he had swallowed a full glass of muriatic acid by mistake. This contains 37 per cent hydrochloric acid. This did not burn much, but he felt pain in the stomach and vomited some of the acid. His stomach was washed out some hours later and he was treated in the hospital for three days. He left feeling normal and had no trouble until 6 weeks later, when he began to experience colicky pains in the epigastrium after eating and vomited everything he ate. There was no difficulty in swallowing and he has had few and small bowel movements with three- and four-day intermissions. Urination about as normal. There has been 20 pounds loss of weight in the three weeks before seeking treatment; and beyond a progressive weakness and hunger he has had no other symptoms. Physical examination negative except his apparent loss of weight and weakness and the evidence of an enlarged stomach with visible peristaltic waves. The distended stomach's lower border was at the umbilicus and there were distinct peristaltic and antiperistaltic waves across the epigastrium. Seven hours after an 8-ounce barium meal, practically none had passed the pylorus.

Urine: some albumin and finely granular and hyaline casts. Blood: hæmoglobin, 80 per cent; white blood corpuscles, 8,600.

Both fluoroscopic and röntgen plate examinations showed no defects in the stomach and a practically closed pylorus. Because his condition became weaker, gastro-enterostomy was decided on.

At the operation the stomach was large, with injected vessels and a constricted area on the lesser curvature. The first part of the duodenum and the pylorus were shrunken and flattened. There were a few fibrinous adhesions about the pylorus, but on palpation there was no thickening or indurated area around a possible ulcer within. Small bowel and colon very contracted, the transverse colon about the width of a thumb. Gastrojejunostomy was performed, followed by death in three days.

Autopsy report: The anatomical diagnosis was cicatricial contraction with nearly complete closure of the pylorus. Cicatricial contraction of the lesser curvature with beginning hour-glass stomach, recent laparotomy with gastro-jejunostomy, bilateral hydrostatic congestion and pneumonia, a few calcified lymph-glands, parenchymatous degeneration of the kidneys and emaciation with atrophy of the viscera.

The man was practically in a starved condition. The result of the ingestion of the acid was unusual in that the œsophagus was not damaged and the pylorus and duodenum received the greatest effect. Earlier gastro-enterostomy would probably have saved his life. Remote effects from burns due to strong alkalies and acids should be borne in mind.

DISCUSSION

Dr. Jacob Frank: It is not often that one has the opportunity of seeing so many of these cases, and the name given them by Dr. Schrager is a new one for an old disease. I have had six patients with this disease in the last twenty-five years and have diagnosed them as meso-arteritis obliterans, although they have also been called intermittent claudications.

We have two such cases now at the German Hospital; one a man from Galveston, Texas, upon whom I operated seven years ago. Dr. Andrews will probably remember the case, as he saw it with me in consultation, and we decided to amputate the leg. One leg was amputated at that time and recently the man has returned and has had the other leg taken off. The leg amputated seven years ago was examined by Dr. Herzog, who found that both the arteries and veins were diseased.

I mention this because I cannot see wherein it will do any good to resort to arteriovenous anastomosis when the veins are diseased. A Wassermann test was made and found positive in this case.

The other case now under observation came from the County Hospital, where a diagnosis of tuberculosis of the os calcis was made. When the patient came to me, I found a small painful bleb on the heel which he had had for months. I incised it, and on account of the fact that there was no bleeding decided at once that it was a case of meso-arteritis obliterans.

In reference to the cases of cancer of the rectum, I recall an extreme case of this disease in a woman where I took out the glands and did such an extensive operation that she had paralysis of both legs and almost uncontrollable pain for some time. An artificial anus was made, and now, five years after the operation, she is living and well.

I think where the glands are removed, the bowel dissected high up, and an artificial anus made, the chances for permanent recovery are excellent.

Dr. David C. Straus: I would like to mention a form of treatment which I believe is of real value in these cases of thrombo-angiitis obliterans, and that is Koga's treatment—hypodermoclysis with Ringer's solution. I first saw the effect of this form of treatment last April in New York, at a clinic held by Dr. Willy Meyer for the members of the Fourth International Surgical Congress. He showed four cases of presenile gangrene or endarteritis obliterans, in which he had tried the Koga treatment with very gratifying results in all four cases, as far as he had gone. In these cases he injected subcutaneously 500 ccm. of Ringer's solution every second or third day, giving two or three injections a week. In these four cases a Wassermann test had been made and was negative.

Koga, the originator of this method of treatment, in his original report, published complete protocols of 13 cases of presenile gangrene in young individuals, all with negative Wassermann. In the early cases, he used daily infusions of 400 ccm. of normal salt solution; later he used 400 ccm. of Ringer's solution daily. In all 13 cases there was definite relief in that the pain, coldness, and intermittent claudica-

tion rapidly lessened and eventually disappeared entirely, the œdema and cyanosis gradually disappeared, a sharp line of demarcation formed, ulcers rapidly cleaned up and healed over, and in some cases certain peripheral arteries which, before the infusion, were pulseless, began to pulsate. In all these cases the viscosity of the blood was above normal before beginning treatment, while during the treatment it gradually fell to normal or below normal, and remained low. The improvement in symptoms went hand in hand with the fall in viscosity of the blood. One or two cases had to be reinjected later, but responded just as nicely the second time. So far as clinical symptoms were concerned, they were definitely relieved for a long time; the first case for two years.

Since last April I have an opportunity, through the kindness of Dr. L. L. McArthur, to try this treatment on two patients and both of them have responded nicely. The first patient, a woman of 65, had had the disease since she was 37. She had her right leg amputated just below the knee, three years ago, for gangrene of the foot. Since the amputation she has had pain in the stump and recently has had beginning symptoms in her left foot; at first numbness, and later pain in the toes, redness, and absence of pulsation in the dorsalis pedis tibialis posterior arteries. I began treating her early in January, giving her an infusion every other day, beginning with 500 ccm. of a modified Ringer's solution and later increasing to almost 1,000 ccm. each time. After the sixth infusion she had no more pain in the left foot—only some numbness; and after the tenth infusion the left foot was entirely free from all symptoms and the amputation stump was greatly relieved. In all I have given her 23 infusions. While she still has some occasional pain in the stump, she has been greatly benefited, and the left foot has remained entirely free from all pain.

The second case was a middle-aged man, who had his right leg amputated below the knee one year ago, for presenile gangrene of the foot. He consulted Dr. McArthur because of pain at the end of his stump, which always felt cold and rather lifeless. I have given him eight injections at intervals of three or four days; that is, twice a week. I gave him only 500 ccm., or a little more each time, because he was rather thin and had little subcutaneous fat, and would complain of tension and pain; whereas the first patient, having plenty of adipose tissue, could tolerate a great deal more fluid. The man, up to the time I first saw him, had been able to sleep only three or four hours each night because of the pain; now he sleeps well and is very enthusiastic over the relief he has received. Although there is still a tender spot at the end of the stump where the skin is adherent to the bone, and a very small moist point in the scar nearby, the stump is now free from pain, feels warm to him and looks pink instead of being very pale, as it was before treatment was begun.

A few weeks ago when Dr. Meyer was in the city I asked him if he was still using this form of treatment, and he said that he was more enthusiastic than ever over it; that he now has 18 cases in which he has tried it, and will publish his results in the near future. He is absolutely satisfied that it does good and thinks it is worthy of trial before resorting to anteriovenous anastomosis or amputation.

I asked Dr. Meyer what effect he believed the solution had, and he said he believed it probably altered the blood in some way. Personally I also believe the solution alters the blood in such a way that it can pass through the blood-vessels more easily.

Dr. Carl Beck: The case of hydrocephalus presented and reported by Dr. McArthur is interesting from the standpoint of the excellent result he has obtained. We have had so far very little success in the treatment of this condition. The method which he has described is one that ought to be more frequently practiced than simple decompression. It is simple and easily performed, even with cocaine anæsthesia.

Some years ago we tried the method of introducing a vein into the brain so as to establish permanent drainage. The vein heals in, but we have found that it does not keep open as permanent drainage. It closes after a while, and I think this method of "Balkenstich" is the best form of treatment.

The cases reported and exhibited by Dr. Schrager do not belong to the class described by Dr. Frank as meso-arteritis obliterans or endarteritis, but they are pathologically a distinct entity. Every surgeon sees many cases of gangrene in young people that are due to endarteritis obliterans or ischæmia.

The term meso-arteritis is a misnomer. Endarteritis obliterans is characteristic of chronic syphilis. It can be shown easily under the microscope that there is a development of endothelium, which gradually leads to obliteration of the vessel and to ischæmia with the resulting gangrene. But these cases presented by Dr. Schrager belong to the particular class of angiospasm or to some other condition which has not been clearly defined and which leads to thrombosis.

It is a young individual who develops gradually these symptoms of slow gangrene, alternating with health, and it is confined more or less to a certain race — the Jewish race. I have seen this gangrene in a number of cases. I have seen it in a young man who was non-Jewish, although his name was Israel. He was the last case we had.

These cases have done very well with the operation of arteriovenous anastomosis. Dr. Halstead has described a case in which I resorted to arteriovenous anastomosis with success.

I have found in the last case a simple method which has led to a cure of the case. This method has been recommended in Germany for other cases of the kind; that is, immersing the leg into hot

and cold water, alternating in quick succession. We did that two or three times, and it was remarkable to see how good the circulation became in the leg, which before showed no tendency toward healing.

It is an angiospasm or some angioneurosis which leads to the development of gangrene, and it must not be confused with endarteritis obliterans, because none of these cases show a Wassermann reaction.

DR. DAVID C. STRAUSS: The eleven cases reported from the Japanese clinic, the four cases Dr. Meyer showed, and the two cases I have mentioned, all showed a negative Wassermann test.

I would like to say also, that careful dissection shows, as Buerger says, that the chief thrombus usually occurs in the popliteal rather than in the smaller vessels. While there is no pulsation in the peripheral arteries, they may nevertheless be patent and the chief thrombus is usually higher up. In one case in which I made a careful dissection, the thrombus was absolutely limited to the amputation area. The thrombus was limited to the popliteal artery and vein and lower than the popliteal vessels the lumina of the various branches of the large arteries were not entirely obliterated or not at all involved, and I think possibly in some of these cases it might be well to do transplanation of the involved, and I think possibly in some of these cases it might be well to do transplanation of the saphenous vein or some other artery to take the place of the artery in that portion, if we could determine roughly where that portion be.

DR. L. L. MCARTHUR: I want to confirm what Dr. Strauss has said with reference to the treatment recommended by Dr. Meyer in two cases. These patients had been addicted to opiates and it was necessary for them to take large doses to get relief, but they obtained more relief after the use of Ringer's solution given hypodermatically.

DR. A. J. OCHSNER: In my personal practice I have found that this condition occurs principally in two nationalities: Jewish and Swedish. The patients that have come to me were erratic in their eating. They ate much salted meat and under a salt-free diet several of them improved considerably, and in several of them the primary necrotic ulcer has healed without an operation. The fact that people of a certain nationality have this condition more frequently than those of other nationalities indicates that they do something that other people avoid or they would not develop this condition.

If Ringer's solution has been modified, it would be interesting to know in what way this was done.

DR. DAVID C. STRAUSS: In looking up the formula for Ringer's solution, one will find that many different formulæ are given, which are slight modifications of the original Ringer's solution. The solution I used was simply one of these various modifications, and consists of

0.9 per cent NaCl
0.024 per cent $CaCl_2$
0.042 per cent Kcl
0.02 per cent $NaHCO_3$

SYMPOSIUM: CARCINOMA OF THE RECTUM

DR. L. L. MCARTHUR read a paper entitled "Carcinoma of the Rectum" (see p. 495).

DR. CARL B. DAVIS followed with a paper entitled "Mortality and Progress in Operative Treatment of Carcinoma of the Rectum" (see p. 497).

DISCUSSION

DR. CHARLES DAVISON: I think Dr. McArthur and Dr. Davis have covered pretty well the subject of the surgical treatment of carcinoma of the rectum. Only a few years have elapsed since operations for carcinoma of the rectum were attended by an extremely high mortality, leaving the patients in a horrible condition while they lived, with recurrence of the disease sooner or later, and death from recurrence. It is not beyond the memory of some of the older surgeons in this room when an operation for carcinoma of the breast was considered a death warrant. When the tumor was simply removed from the breast and the glands in the axilla were left alone, the patients all died. But under the direction and teaching of such men as Halsted, Rodman, Warren, and others, we later learned that it was important to take out the lymphatics and their connections. Surgeons are beginning to learn that a similar development in technique offers something for carcinoma of the rectum. It is only by following out the anatomical circulation of the lymphatics and going beyond the infiltration of the tissues that any prospects of success are likely to be attained. The general consensus of opinion of surgeons now seems to be in the line of the two-step operation, and the former high mortality of 50 per cent has been reduced by the best operators in the last two or three years to only 12 or 14 per cent.

The operation consists of opening the abdomen in the middle line, dissecting free the diseased intestine well above and below the tumor, cutting across the intestine well above the tumor, entirely above the malignant infiltration, using the proximal end to form an artificial anus and invaginating the distal end and the tumor through the rectum to be removed as a second step of the operation at a later time.

Some of the best surgeons are making a simple artificial anus, using the rectus muscle as a sphincter. The rectus muscle is under mental control, as is the sphincter muscle of the rectum, and it probably makes as good a sphincter as the elaborate method that has been described tonight.

The development of technique along the lines of extensive careful dissection, following the malignant infiltrations and the lines of lymphatic drainage, it seems to me, will give these patients a fair prospect of life, possibly a prognosis as good or better than in any other internal cancer.

DR. E. WYLLIS ANDREWS: In company with Dr. Ochsner and others we saw the demonstration of Hochenegg's work and the results of his technique in 1912 while visiting Vienna. Some of us had

seen the method before, and we were struck with admiration at the bloodless way in which he did the Kraske operation. We were particularly impressed by the enormous amount of material which he had collected at considerable expense and labor to show us. He had these patients brought from all over Austria, and some of them had gone as many as twenty years without recurrence of the disease. It was a highly interesting and instructive demonstration of a wonderful system and perfection of scientific records as well as a good percentage of cures. In spite of this, however, I cannot help but agree with what the speakers have said tonight, that we are drifting toward the combined operation of the upper and lower routes, the method described by Quénu and beautifully illustrated in a series of monographs by Tuttle of New York.

There are three points to be considered in the combined or upper-loop operation. One is greater mobilization. This statement may strike you as paradoxical: the more you cut off the sigmoid, the more you can pull it down. You cannot draw the sigmoid down into the rectum unless you make a high section. If you go away up toward the wide loop, you can loosen it. There again, we have the advantage of splendid control of hæmostasis, which helps materially if we do the combined operation. We cannot pass this point without stopping to pay a tribute to Dr. Carl Davis for his beautiful study of the arrangement of the vessels of the mesosigmoid. If you cut too high or too low, you take chances either of hæmorrhage below, or gangrene of the loop of the sigmoid by having one loop vessel too high. Working in the pelvis, you have a dry field. You are working in the Trendelenburg position; the intestines are out of the way, and there is a beautiful dry dissection of all of the tissues as high, or a little higher, than the promontory of the sacrum.

The vital point is the hæmostasis, which, to my mind, is the key to success in getting primarily a low mortality. I believe the high mortality connected with the Kraske type of work is due largely to the shock produced by the loss of blood in the different steps of the operation. There is a way of making a bloodless operation by the sacral route, but most operators until a few years ago did not know it. When they went in above the by combined method they got a more bloodless field in which to work.

Dr. Coleman G. Buford: I was interested in the X-ray plate exhibited by Dr. McArthur, which showed where bismuth paste had been injected into a sinus leading into the trachea and had been aspirated, causing pneumonia.

About three years ago a child of eight or nine years, suffering from what we supposed was a local empyema, was operated on by me at the Children's Memorial Hospital. The wound continued to discharge for many weeks, and I finally had my interne inject the sinus with bismuth paste, with a view of having a radiogram of the chest made. To our surprise he reported the paste appeared in the child's mouth with astonishing rapidity and was spit out without causing coughing or other trouble. This seemed so unbelievable that I had him repeat what he had done in my presence, and found that his report was correct. We afterward used the bismuth paste for curative purposes. The sinus which had remained open so long, closed with surprising rapidity.

Dr. E. Wyllis Andrews: In connection with what Dr. McArthur has said I am reminded of a case in which an enormous quantity of paste was accidentally insufflated into the trachea, and death resulted promptly from a general diffuse filling up of the bronchi and alveoli.

Dr. Carl Beck: In the cases cited by Dr. McArthur and by Dr. Andrews, the paste was evidently introduced into the mouth, but if it is introduced from below, as in Dr. Buford's case, it will not cause a fatal result. In many cases, where you inject bismuth paste into a fistula, and the patient coughs and spits up a large quantity of the paste and pus with it, it will be retained in cavities in the lung for a long time. There is a physiological explanation for the expectoration. The epithelium is ciliated in the upper trachea and bronchi. If we inject an abscess, for instance, which communicates with a large bronchus, the paste which goes in irritates the epithelium in the same manner as the discharge of the lung and creates expectoration, and the patient will expel it. If, however, bismuth gets into the small bronchi, where the ciliæ are not present, it cannot be expectorated. It was an aspiration pneumonia that Dr. Andrews' patient had; the bismuth paste had entered the small bronchi. If the cavity communicates with a larger bronchus, which has ciliated epithelium, the paste does no harm.

Dr. McArthur: They were told to inject bismuth cream in a fluid state, so that it could be washed out. They introduced Beck's paste to get a photograph of the sinus. The paste was not used for curative purposes, but for diagnostic purposes to determine the course of the channel. Then, when they tried to wash it out, they forced it the wrong way, washing it down into the trachea. If the paste had been made with water, as advised, it might have been expectorated and would have come out of the small bronchi.

Dr. Beck: If they had forced the bismuth paste from an abscess into the trachea, it would have been expectorated. There must have been a small opening in the trachea through which a little of the paste passed gradually and then was aspirated, which, in an asthenic patient, would naturally result fatally through aspiration pneumonia.

Dr. A. J. Ochsner: I wish to speak of some points that are of practical importance. For many years I carried the intestine out directly underneath the lower end of the sacrum, thinking that in this

position the pressure of the intestine against the sacrum would serve as a valve which would add to the comfort of the patient. Some years ago, when Professor Graser was visiting Chicago, I happened to have a case in which I made an excision for cancer of the rectum, and he told me that it would be better to carry the intestine directly down in the center of the incision and leave an opening in the soft tissues. I carried out his suggestion, fastening the intestine by means of a number of strands of chromicized catgut, so that the tension came on the outer portion; and the result was so much more satisfactory than it had been with the old operation that since then I have constantly performed this operation and have found that the patient is really much more comfortable than when the opening was made higher up directly underneath the sacrum.

When one makes an excision of a very high carcinoma of the rectum and uses the method described by Gibson, placing a rubber tube in the upper segment, and drawing this into the lower segment, the upper segment should be twisted in one direction and the lower segment in the other direction, so that where there as no peritoneal covering of one segment there shall be peritoneal covering on the other. This is the same principle that Murphy pointed out many years ago in connection with all end-to-end anastomoses; but in this particular operation it is of the greatest importance, because if this is not done there is sure to be leakage.

One should not take too large a rubber tube, because the lower segment is often very much smaller than the upper segment.

Dr. J. Rawson Pennington: Formerly the recognized division between the rectum and the sigmoid was at the point of the bowel opposite the left iliosynchondrosis. Now embryology seems to furnish a better explanation for this division and fixes it at about the middle of the third sacral vertebra. The rectum is developed from the post-allantoic gut and is the fixed part of the bowel. It extends from the third sacral vertebra to the pectinate line. At the junction of the rectum and sigmoid, and at the pectinate line, there is a slight constriction in the bowel. Near the former is located one of Huston's valves. One, and sometimes two, additional valves are located in the ampulla. These constrictions and valves favor traumatism, which is a predisposing cause of cancer. It is quite generally conceded that cancer never initiates in healthy tissue, but that it has a tendency to attack tissues that are already injured or diseased.

The treatment of cancer of the rectum is preventive, curative, and palliative. The former is by far the most important. The next in point of importance is the curative treatment.

As to the curative treatment I believe that the perineal, Kraske, and other operations done from below exclusively should be less frequently performed, if not condemned. Miles, of London, found by post-mortem examinations that in cancer of the rectum and the distal part of the sigmoid there were three directions of spread—the upper, lateral, and downward spread—and that it made very little difference as to the degree of spread, whether the cancer occurred in the lower part of the rectum or the distal part of the sigmoid. From these observations he planned a method of operating which he called the abdominoperineal operation, with an inguinal colostomy.

The technique in part is as follows: The patient is placed in a high Trendelenburg position, an incision made from the pubis to the umbilicus. The left ureter is located so as to avoid injuring it, and the inferior mesentery artery ligated. Then the sigmoid is divided and the ends closed. The mesentery of the sigmoid is then divided transversely back to the promontory of the sacrum. The peritoneum on each side of the bowel, and about one inch from it, is now divided down to the cul-de-sac. These incisions are carried forward so as to meet in front of and between the bladder and rectum in the male, or the vagina and rectum in the female. The bowel and all tissues posterior to it and in front of the sacrum are detached down to the coccyx. The rectum is next detached anteriorly and laterally. The distal portion of the bowel is carried down into the pelvis and the peritoneum closed over it. The abdominal wound is then closed and the patient is placed on the left side, the coccyx removed and the operation completed. According to the last report which I saw he had operated on sixty-seven cases. His recurrences were 7.4 per cent. Of these sixty-seven cases, thirty-seven are living and apparently well. He did his first operation in 1906.

I have done two of these operations. The technique, however, I have varied slightly. First, I did not divide the sigmoid until ready to close. Second, in doing the perineal part of the operation I placed the patient in the lithotomy position, purse-stringed the anus, did not remove the coccyx, but made an incision, as in doing a perineorrhaphy, and carried it around the rectum, so as to include the sphincters, and upward to meet the incision of the detached part of the bowel from above. The wound was dressed with a piece of rubber sheeting and gauze. This was removed at the end of seventy-two hours, and a dressing of drawn gauze and subnitrate of bismuth ointment applied. This form of dressing was repeated every forty-eight hours throughout the course of treatment. Both patients made an uneventful recovery.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN, M.D., St. Louis

THE present status of operative gynecology is very clearly set forth in the preface of a new book[1] on that subject. "Gynecologic surgery," says the author, "is entering a new stage of development. The past may be designated the period of invention of methods. To such an extent has this been carried that for the treatment of uterine displacement alone more than one hundred operative procedures have been devised. The new stage of development may be designated the period of adaptation of operative methods to the exact pathologic conditions present in the individual case. This period of development is as important as the preceding one, perhaps more so when considered from the standpoint of lasting benefit to the patient." Instead of adapting all cases to one particular procedure championed by the operator, our treatment must be truly selective.

With this object in view the author has devoted fourteen out of the nineteen chapters of his book to the operative treatment of the various conditions encountered in gynecologic practice. Each chapter presents the technique of the different operations devised, the difficulties likely to be encountered, the indications for surgical intervention, and the selection of the exact form of operative procedure best suited to the particular case. For details of etiology, pathology, symptomatology, diagnosis and prognosis, the reader is referred to the author's *Textbook on Diseases of Women* which, in its second edition, appeared not long ago.

The opening chapters on retrodisplacement and prolapse are masterpieces of methodical, lucid, and exhaustive presentation of the matter. Fistulæ, fibroids, carcinoma, ovarian tumors, inflammatory conditions, etc., are treated with equal exactness. The diction is clear and precise, and seven hundred and seventy semidiagrammatic and instructive illustrations help to leave no point unexplained.

In two chapters, the general principles underlying abdominal and vaginal operations are discussed while an associated chapter gives minute instructions as to the after-treatment. Chapter xviii presents a very interesting commentary on gynecologic surgery in nervous patients, and the concluding chapter, xix, deals with certain medicolegal points.

The wide experience of the author as an operator and a teacher manifests itself on every page, and it is safe to say that the book will meet with a warm reception on the part of the profession.

THE somewhat unusual title of a book[2] fresh from the press, raised in us pleasant expectations which were still further increased by the opening paragraph of the preface. "The majority of the patients who come to the gynecologist for advice suffer from the effects of injuries sustained during labor. Often the actual pathology involved has not been recognized or, if recognized, has been underestimated by the general practitioner."

As all this is true enough and does not permit of discussion, the author had a splendid opportunity to do missionary work and to elevate midwifery from its present level to that of scientific obstetrics. Such an object, the author thinks, would be accomplished, were trachelorrhaphies and perineorrhaphies more correctly performed and their importance to the physical and mental well-being of the mothers better understood. With this end in view he presents a detailed description of the anatomy of the cervix and perineum and the mechanics of the relaxed outlet; but he encumbers these chapters, as well as another on the pathology of the cervix, with a good deal of totally extraneous matter. It is, for instance, not clear why in connection with obstetrical injuries, infections and malignancy of the cervix should be elaborately discussed and illustrated with numerous microphotographs.

There is a profusion of illustrations many of them of only moderate didactic value, in this short monograph of 183 pages; yet, where they are most needed, we look in vain for them. The chapters on curettage and on immediate or delayed repair of birth injuries contain lengthy descriptions but practically no pictures of the various surgical steps proposed, which to the beginner would be more valuable than even the most graphic accounts of operative procedures.

But, one is forced to ask, does a book which lays its greatest emphasis on the surgical aspect, aim at the very heart of the question? Should the term "gynecology of obstetrics" be synonymous with "repair work" which in itself is so very often

[1] Operative Gynecology. By Henry Sturgeon Crossen, M.D., F.A.C.S. St. Louis: C. V. Mosby Co., 1915.

[2] The Gynecology of Obstetrics. By David Hadden, B.S., M.D. New York: The Macmillan Co., 1915.

a proof of obstetrics poorly done, and would the problem as a whole be solved even if it were possible to repair correctly all traumatisms of parturition? Should not in this age and generation of prophylaxis, the true watchword be *prevention*?

If only, instead of a few brief remarks on the value of prophylaxis, the descriptive skill of the author had been enlisted to preach to the profession how much might be done by proper preventive measures! For instance, an emphatic warning against the high and "floating" forceps would do more for the patient than the description of the operation which eventually will have to remedy the hasty and injudicious action of the obstetrician. The proper care of the abdominal walls in pregnancy and puerperium would do more good than any of the appliances recommended for the correction of kidney ptosis.

We do not wish to belittle the good intentions of the author. Yet, the object of this department of SURGERY, GYNECOLOGY AND OBSTETRICS is that of a *critical* review, not merely an enumeration of the contents of new books, and while we are only too glad to acknowledge what, in our subjective opinion, seems good and valuable, the study of this particular book has failed to convince us that the author has made the most of his opportunities.

THE title of this book[1] which has just appeared in its second edition, explains its purpose. The two collaborators are well known as joint authors of a textbook on gynecology. By leaving out the physiology and management of normal pregnancy, labor, and puerperium, they have gained space for a more detailed discussion of all obstetric complications than is usually found in textbooks on obstetrics. One may, perhaps, argue the wisdom of thus divorcing normal from pathologic obstetrics, but, on the other hand, every promising attempt at equipping the obstetrician more fully for his task, should be welcomed. The book in hand offers every guarantee that it will accomplish this object. It speaks a direct and convincing language and with the help of three hundred and two excellent illustrations leaves the student at no time in doubt as to the proper course to pursue at any stage of the emergency he may encounter. A book which fits its reader for his work, does a great deal of good even beyond the immediate need, for it lays the foundations for a gynecologic prophylaxis in obstetrics such as we have discussed in the preceding review.

Another gratifying feature is the careful attention given to complications arising from quarters other than the genital sphere. One hundred and twenty-two pages are devoted to the relations between pregnancy and disorders of the intestinal and urinary tracts, of the peritoneum, the gall-bladder and spleen, the skin, the ductless glands, the nervous system, the circulatory system, the respiratory tract, and acute infectious fevers. These nine chapters make very interesting reading and afford much information even to the advanced student. The prevalence of influenza in this country, to select this illustration, should remind us of the fact that it has been noted that children born under this condition are weak and often die early. In severe cases the uterus is likely to empty itself prematurely, and this especially in the pneumonic type. From observations made in Switzerland, where the number of births was 5,000 less than the average of the four years previous to an epidemic of influenza, it has been argued that this disease may be a cause of sterility.

In the question of consanguineous marriages, the authors are in accord with the most modern teaching that in the marriage of first cousins there is nothing that necessarily leads to a deterioration of health or to mental weakness in their offspring. Their authorities are Thomson and Ross while Rohleder, perhaps the foremost exponent of the subject, is not mentioned. The book follows rather closely national lines, and the literature considered is, in the main, taken from English sources. This is particularly evident in the discussion of scopolamine-narcophine narcosis where the experiences of a British author are given while those of Krönig and Gauss are omitted.

Here and there we find expressions which sound foreign to our ears. The malacosteon, *i.e.*, osteomalacic pelvis, is one of these terms.

The pictures on pp. 672 to 675 will bear revision. In performing the Porro operation after cæsarean section, the authors seem first to sew up the uterine incision before proceeding to the removal of the organ by supravaginal amputation — a time-consuming and superfluous nicety. Conversely, the picture on p. 690 indicates that after salpingo-oöphorectomy the stump of the ligament is left raw and unprotected against formation of adhesions, apparently in order to save time.

Summing up, we may say that the book is very pleasing and that it will be read with profit by obstetricians, young and old.

[1] THE DIFFICULTIES AND EMERGENCIES OF OBSTETRIC PRACTICE. By Comyns Berkeley, M.A., M.D., M.C., Cantab., F.R.C.P., Lond., M.R.C.S., Eng. and Victor Bonney, M.S., M.D., B.Sc., Lond., F.R.C.S., Eng., M.R.C.P., Lond. Second Edition. Philadelphia: P. Blakiston's Son & Co., 1915.

Clinical Congress of Surgeons of North America

SIXTH ANNUAL SESSION

BOSTON

OCTOBER 25 TO 29, 1915

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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THE CLINICAL CONGRESS OF SURGEONS IN BOSTON

FOLLOWING the plan successfully carried out at previous sessions of the Congress, arrangements have been made for a series of evening meetings during the Boston session, at which eminent surgeons will read and discuss papers dealing with surgical subjects of present-day interest. A tentative program of these evening sessions will be found on the following pages. It will be noted that this program provides for one meeting on Monday evening, while on Tuesday, Wednesday, and Thursday evenings there will be two meetings — one for the general surgical division, in the ballroom of the Copley-Plaza, the other for the division of surgical specialties, at the Boston Medical Library. These meetings will open promptly at 8 o'clock and adjourn not later than 10:30.

Many changes have been made in the clinical program as published in this department, and still further changes are to be made previous to the week of the session. It will be understood that the published program is a provisional one — the real program of the Congress being the schedule of clinics and demonstrations posted each afternoon on the bulletin boards at headquarters, where the cases to be operated upon or demonstrated at the clinics will be given in detail.

The committee on arrangements has planned a complete showing of Boston's clinical facilities in every department of surgery, including gynecology, obstetrics, genito-urinary surgery, orthopedics, and surgery of the eye, ear, nose and throat. In addition there will be a series of demonstrations and lectures on borderline subjects given by a number of eminent Boston surgeons and internists.

LIMITED ATTENDANCE

As was originally announced, attendance at this session will be limited in number, following the precedent established at the London session of the Congress in July, 1914. A careful survey of the operating amphitheaters, lecture rooms, and laboratories of the several hospitals and medical schools in Boston, as to their capacity for accommodating visiting surgeons, has been made, and

based thereon the limit of attendance has been fixed at 1500. All members of the Congress have been notified of this plan and of the necessity for registering in advance.

At this date, 1400 registrations have been received at the office of the Secretary-General, and it is obvious that the required number of registrations will be reached in advance of the meeting. When 1500 registrations have been received no further cards will be issued. The popularity of these meetings has become so great that this plan of limiting the attendance and requiring advance registration, which proved so satisfactory at the London session, has been decided upon to prevent overcrowding. A formal receipt is mailed to each member upon receipt of the registration fee, which receipt is to be exchanged for a membership card upon presentation when registering at headquarters.

SPECIAL TICKETS

The use of special tickets at previous sessions has fully demonstrated the efficacy of this method of providing for the distribution of the visiting surgeons among the various clinics and demonstrations, and to prevent overcrowding, as tickets for any one clinic or demonstration are limited in number to the actual capacity of the room in which the clinic or demonstration is to be given. Special tickets will be issued at 8 o'clock each morning for the clinics and demonstrations to be held that day, the complete schedule of clinics and demonstrations having been posted on the bulletin board during the afternoon of the preceding day. A printed schedule of the clinics and demonstrations will be distributed at 8 o'clock each morning.

HEADQUARTERS

Headquarters will be established at the Copley-Plaza, which is centrally located in the Back Bay district and from which any of the hospitals and medical schools can be reached in a few minutes. The hotel is located only a block and a half from the Back Bay and Huntington Avenue railroad stations.

The Congress headquarters will be on the ground floor of the hotel where there is ample space for the registration and ticket bureaus, bulletins, etc. The large ball room in which the evening meetings are to be held is also located on the ground floor.

To enable the visiting surgeons to find their way about the city, a directory of the hospitals will be issued for free distribution. This will contain explicit instructions for reaching any of the hospitals or medical schools from headquarters.

Headquarters will be open on the afternoon of Saturday, October 23rd, and all day Sunday, October 24th, for the registration of members, and it is urged that members plan to arrive in Boston not later than Sunday evening, in order to complete preliminaries before the opening of the Congress on Monday morning. The clinical schedule for Monday will be posted on Saturday afternoon.

REGISTRATION FEE

The constitution of the Congress provides that a registration fee shall be required of each member attending an annual meeting. There are no annual dues. The registration fees provide the funds to meet the expense of preparing for and conducting the annual meetings so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

HOTELS

The executive committee is informed that the Boston hotels are usually well filled at this season of the year, and would strongly urge members to make their hotel reservations at once. Other first-class hotels in the vicinity of the Copley-Plaza (the headquarters) are: The Lenox, Brunswick, and Victoria.

REDUCED RAILWAY FARES

On account of the Boston meeting, the railways in the eastern portions of the United States and Canada have granted certain reductions in fares in selling round trip tickets. In the eastern part of the United States the fare will be two cents per mile in each direction, going and returning via the same route only, and over which one-way tickets are regularly sold. This rate will be in effect in the territory covered by the railway lines in the New England Passenger Association, Trunk Lines Association, Southeastern Passenger Association and Central Passenger Association, which covers practically all of the states east of the Mississippi River. Members living in the Western Passenger Association territory, that is, west of Chicago and St. Louis, should purchase tickets to the above gateways and then repurchase a round trip ticket to Boston in order to avail themselves of the special reduced fares. In Canada practically the same rates prevail as far west as Port Arthur. Tickets will be sold from all points on October 22, 23 and 24 with a final return limit to reach one's original starting point on or before midnight of November 3.

PRELIMINARY PROGRAM OF EVENING MEETINGS

GENERAL SURGICAL DIVISION—In the Ballroom of the Copley-Plaza at 8 p.m.

Presidential Meeting, Monday, October 25th

Address of Welcome by FRED BATES LUND, M.D., Boston, Chairman of the Committee on Arrangements.
Presentation of President WILLIAM L. RODMAN and President-Elect RUPERT BLUE of the American Medical Association.
JOHN B. MURPHY, M.D., Chicago: Address of retiring president.
Inauguration of President CHARLES H. MAYO, and Vice-Presidents HERBERT A. BRUCE and ROBERT L. DICKINSON.
Presidential address by CHARLES H. MAYO, M.D., Rochester, Minnesota.

Tuesday, October 26th

THOMAS B. HARTZELL, M.D., Minneapolis: The Dental Path, Its Importance as an Avenue of Infection.
E. H. SANFORD, M.D., Rochester, Minnesota: Studies in the Relationship of Amœbiasis to Pyorrhœa Alveolaris.
WESTON A. PRICE, M.D., Cleveland: Cinematographic film showing movement of bacteria and amœba.
M. L. RHEIN, M.D., New York City. Discussion.
GEORGE W. CRILE, M.D., Cleveland: Acidosis in Its Relation to Surgery.
Professor LAWRENCE J. HENDERSON, Boston: The Nature of Acidosis.
JAMES S. STONE, M.D., Boston. Discussion.

Wednesday, October 27th

A. J. OCHSNER, M.D., Chicago: Intestinal Stasis and Its Accompanying So-called Toxæmia.
Discussion by JOHN G. CLARK, M.D., Philadelphia; Professor WALTER CANNON, Boston; FRANK W. SMITHIES, M.D., Chicago.
Symposium: Plastic Bone Surgery. (Illustrated by lantern.)
FRED H. ALBEE, M.D., New York City.
HARRY M. SHERMAN, M.D., San Francisco.
JOHN B. MURPHY, M.D., Chicago.
CHARLES L. SCUDDER, M.D , Boston.

Thursday, October 28th

Symposium on Cancer: Speakers to be announced.
Symposium on Military Surgery: GEORGE W. CRILE, M.D., HARVEY CUSHING, M.D., ROBERT B. GREENOUGH, M.D., EDWARD H. NICHOLS, M.D., ROBERT B. OSGOOD, M.D., and others.

DIVISION OF SURGICAL SPECIALTIES

At the Boston Medical Library, 8 Fenway, at 8 p.m.

Tuesday, October 26th

WALTER R. PARKER, M.D., Detroit: Ophthalmological paper, subject to be announced.
Discussion by GEORGE S. DERBY, M.D., Boston, and ALEXANDER QUACKENBOSS, M.D., Boston.

Wednesday, October 27th

B. A. RANDALL, M.D., Philadelphia: Otological Localization, Peripheral and Intracranial.
Discussion by E. W. TAYLOR, M.D., Boston, and D. HAROLD WALKER, M.D., Boston.

Thursday, October 28th

J. L. GOODALE, M.D., Boston: The Administration of Vegetable Proteids in Hay Fever.
Discussion by FRANK W. HINKEL, M.D., Buffalo, and WALTER F. CHAPPELL, M.D., New York.

THE HOSPITALS AND MEDICAL SCHOOLS OF BOSTON

V.—A Group of Boston's Public Hospitals

PETER BENT BRIGHAM HOSPITAL

The Peter Bent Brigham Hospital, built in 1913, on Huntington Avenue and Francis Street, adjacent to the Harvard Medical School, was founded by Peter Bent Brigham, who died in 1877. Its total cost was $1,400,000 and it has an endowment of $5,000,000. The purpose of its founder was that a hospital might be established "for the care of sick persons in indigent circumstances residing in County of Suffolk." The hospital consists of five pavilions for patients and ten other buildings, so constructed as to be fire-proof throughout and so that each patient may be given the optimum amount of sunshine and fresh air with easy transport out of doors. It has 225 beds, half for medical cases and half for surgical. The type of cases are chiefly adult, non-contagious, acute, or chronic with acute

Peter Bent Brigham Hospital and I

exacerbation, medical or surgical. The medical staff consists of a physician-in-chief, one physician, three associates in medicine, four resident physicians and eight medical house officers.

The surgical staff consists of a surgeon-in-chief, two surgeons, three associates in surgery, one supervisor of anæsthesia, four resident surgeons and eight surgical house officers. The pathological department has one resident pathologist and a pathological interne. The administrative department consists of a superintendent and three assistant superintendents.

The relation of the hospital to the Harvard Medical School is close and friendly, but not integral, as shown by dual positions of the staff of the hospital, and the fact that students from Harvard Medical School are taught at the hospital. The management of the hospital, however, is by an independent board of trustees.

THE CHILDREN'S HOSPITAL

The Children's Hospital is situated on Longwood Avenue, adjacent to the Harvard Medical School, with which it is closely affiliated. The visiting staff of the hospital is appointed by the managers, but is nominated by the corporation of Harvard University. Furthermore, the visiting staff includes a bacteriologist, a chemist, a physiologist, a pharmacologist, and a pathologist,

Harvard Medical School

Collis P. Huntington Memorial Hospital

omestic Building | Pavilion A | Administration Building | Entrance Lodge | Outdoor Department Nurses' Building (in Rear)

Hospital and Institutions in the Vicinity

Peter Bent Brigham Hospital, Typical Pavilion

Peter Bent Brigham Hospital, Interior of Pavilion

Peter Bent Brigham Hospital, Respiration Laboratory

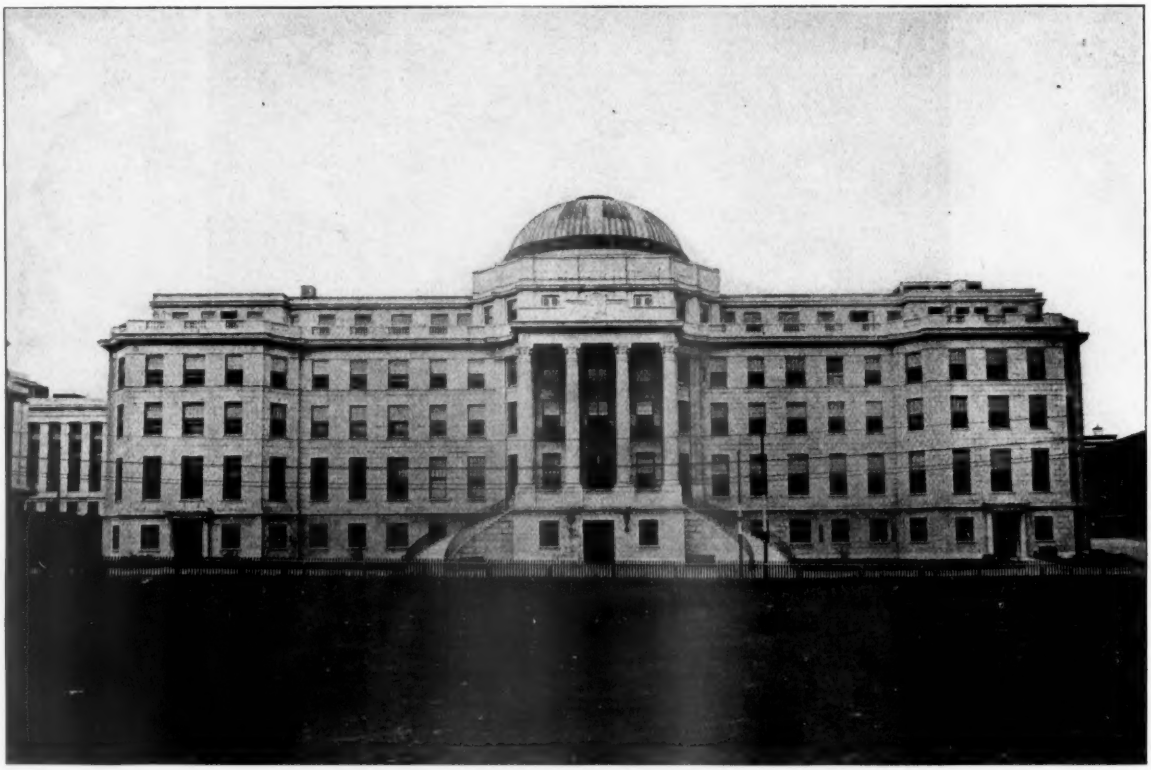
all of whom are appointed in the same manner as are the visiting physicians and surgeons. In this way the affiliation with the laboratory departments of the Harvard Medical School becomes very intimate and is of great advantage to the hospital.

There are three main departments to the hospital: medical, surgical, and orthopædic. As a subdivision of the orthopædic department there is the scoliosis clinic; and in addition there is a throat department, which has beds in the hospital, a neurological department, a department of röntgenology, a department of physical therapeutics, and a special clinic for the treatment of paralytic cases. The social service is also one of the active departments, and there is of course a training school for nurses in connection with the hospital. A surgical appliance shop is also maintained for the purpose of supplying splints and apparatus to patients at cost.

The hospital moved from its old building on Huntington Avenue to its present quarters in the spring of 1914. The main building on Longwood Avenue is comprised of three parts, the Central Administration building, the Anne White Vose Nurses' Home on the east, and the Hunnewell building for out-patients on the west. The main building is fire-proof throughout, five stories in height, and is built of a concrete conglomerate of crushed trap rock, sand, and Portland cement having a natural gray color.

Great attention has been paid to the construction of the pavilion wards four in number. In planning them three points were kept constantly in mind: (1) ventilation, (2) out-door treatment, and (3) the control of contagious disease. It was considered that no system of artificial ventilation was satisfactory, that in order to secure really fresh air windows must be open, that the most satisfactory natural ventilation was secured by the passage of used air upward and out through openings at the top of the room. It was further thought essential that spaces of non-circulating dead air be eliminated. These two objects have been attained by wards with monitor tops and sloping ceilings.

In the two-story wards the monitor form is retained in both the upper and lower floor, and the ventilation in the lower story is not interfered with in the least by this arrangement, as the outer walls between the eaves of the lower story and the floor of the second story are merely open lattices between the necessary supporting columns Thus the out-door air has free access to the windows in the monitor top. The balconies of the second floor, though wide, are so high above the windows of the first floor that they do not shut off the sunlight.



Children's Hospital, Main Building

The problem of securing out-door treatment has been met by having wide windows on the southerly side of each ward extending to the floor and sliding back so that the beds may easily be pushed out on to broad piazzas.

The limitation of contagious disease is one of the problems constantly confronting the administrators of a children's hospital It is important that the size of the open wards should be limited. Each half of each ward contains ten beds and one isolation room. These isolation rooms have proved of great value. Any patient presenting suspicious symptoms of contagious disease is at once transferred to this room for observation and for such future disposition as may seem best.

The operating rooms are in a special building. At one end is an amphitheater seating eighty-three, with a separate entrance from the street for students. This amphitheater is planned rather for lectures and demonstrations than for ordinary operations. Ordinarily all the operating is done in four small rooms, designed especially to give students a good view of what is being done. Low galleries at a height of about six feet above the floor are placed at the sides of the rooms. In each of these galleries six persons may sit, and at least six may stand and look over the shoulders of those sitting. Screens of plate glass placed at an angle in front of the seats prevent dirt from passing down on to the table or patient. Two of these rooms are used for clean operations, one for plaster-of-Paris work, and one for operations on septic cases.

In the year 1914 there were admitted to the hospital 2,534 ward patients, of whom 592 were medical, 810 surgical, 693 orthopædic, and 439 throat patients. There were treated in the out-patient department 6,776 new patients, of whom 2,697 were medical, 1,358 surgical, 902 orthopædic 100 lateral curvature, 113 paralytic, 384 nerve, and 1,222 throat patients, while the whole num-

Children's Hospital, Typical Ward Building

ber of visits made to the out-patient department amounted to 36,188, distributed as follows: medical 11,213, surgical 4,657, orthopædic 5,878, lateral curvature 4,803, paralytic clinic 6,088, nerve 1,474, throat 2,075. There were 1,884 operations performed on house patients, 652 in the surgical service, 444 in the orthopædic service, and 788 in the throat service.

COLLIS P. HUNTINGTON MEMORIAL HOSPITAL

The Collis P. Huntington Memorial Hospital located on the grounds of the Harvard Medical School is used for the clinical study of benign and malignant tumors by the Cancer Commission of Harvard University.

The hospital contains twenty-five beds and is equipped with an X-ray apparatus for diagnosis and treatment, laboratories for radium work, clinical laboratories, operating room, and examining rooms for out-patients.

During the past year and at the present time the Cancer Commission is engaged in an investigation of the value of radium and X-ray in the treatment of cancer and allied conditions.

ROBERT BENT BRIGHAM HOSPITAL

The Robert B. Brigham Hospital was built with funds left by Robert B. Brigham and his sister, Miss Elizabeth B. Brigham. According to the will, the hospital was for the poor of Boston who were afflicted with chronic or incurable diseases.

The hospital has accommodations for 150 patients, and is fully equipped, expecting to receive the chronic patient with the idea of carrying on the most exhaustive study as to the nature of the difficulty and for treatment irrespective of the time required.

The staff is organized with a physician-in-chief, who is in charge of the medical service of the hospital. All cases are admitted to him and he is responsible for the cases during their stay in the hospital. He has as associates on the staff a surgeon, an orthopedist, a laboratory director who is a physiological chemist, and other specialists.

The hospital is fully equipped for the most difficult surgical and medical work, and careful physiological tests and chemical examinations are being carried on in the hope of finding the causes of the chronic disease condition, from which the proper treatment may be learned.

Naturally the patients remain in the hospital for long periods, there being no limit to the time, but the hospital is distinctly not a home, so that when the patient ceases to require medical treatment he is discharged.

Huntington Memorial Hospital

INFANTS' HOSPITAL

The Infants' Hospital was incorporated January 19, 1881, and for many years was on Blossom Street, in the West End of Boston. It was the first hospital in Boston to admit sick babies, and the first hospital in the country to restrict its patients to the first two years of life. The late Dr. Henry Cecil Haven was the founder, and soon after its establishment the late Dr. Thomas Morgan Rotch joined him in the work, and later took charge. Dr. Rotch was the inspiration for the beautiful new building on Van Dyke Street, near the Harvard Medical School, into which the hospital moved on March 3, 1914.

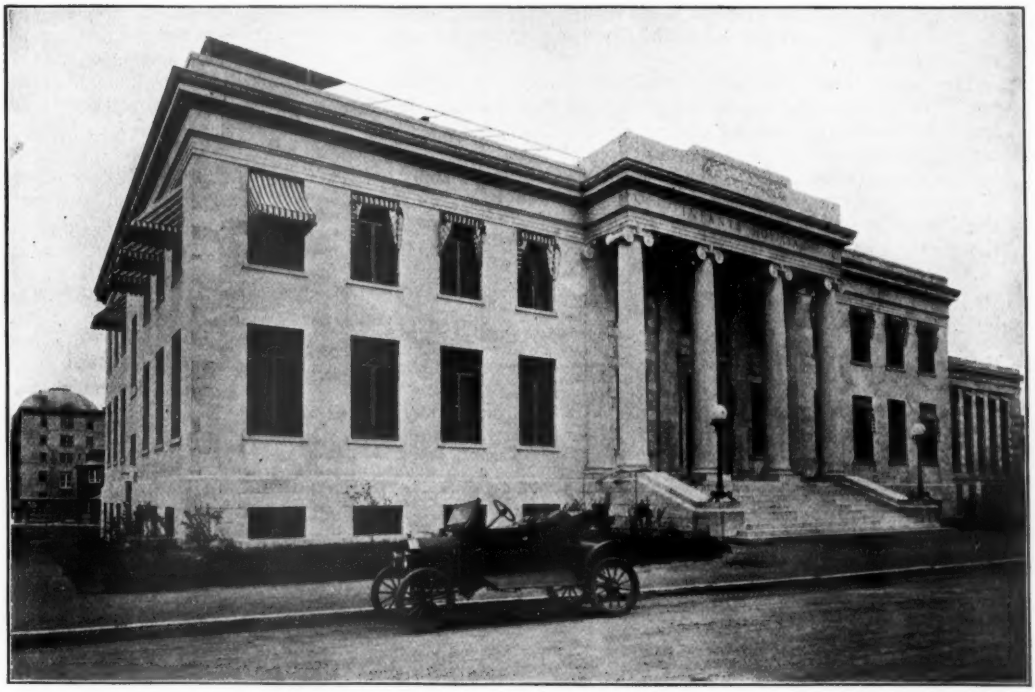
The activities of the hospital are as follows: The medical care of sick infants under two years of age. There are 65 beds, of which only 22 are now in use, owing to lack of funds. Patients are received from other hospitals and from physicians. There is no out-patient department. The hospital maintains a special laboratory for the preparation of modified milk and other feeding mixtures.

Research work is carried on in the hospital wards and in the Pathological Laboratory. Instruction is given to third and fourth year students of the Harvard Medical School, sections being taught in the wards and in the Milk Laboratory. Summer courses are given for students registered in the Harvard Graduate School of Medicine. Interneships with a three months' term are open to students and graduates.

Other activities include: Instruction to students from the Garland School of Homemaking; courses for mothers on the care of the baby and the modification of milk; a social service, babies being visited in their homes after discharge from the hospital; wet nurse directory; sending carefully tested wet nurses to all parts of New England; a four months' training in the care of infants for pupil and graduate nurses; a special training for nursery maids, comprising a six months' course in the hospital, after which they are qualified to take the entire charge of a well infant.

FREE HOSPITAL FOR WOMEN

The Free Hospital for Women is situated in Fenway Park on Park Avenue, a short distance from Brookline Village, and is devoted exclusively to the treatment of gynecological cases. The main hospital contains 67 beds for surgical patients. Connected with it is an out-patient



Infants' Hospital, Rotch Memorial Building

clinic which is open morning and afternoon every day excepting Saturday afternoon.

The hospital is affiliated with the Harvard Medical School, the chief of staff being also professor of gynecology in that school. Undergraduates are given gynecological instruction in the wards and operating rooms, in the out-patient clinics and in the pathological laboratory. Instruction is also given to a limited number of post-graduate students.

The hospital is literally a free institution, no charge being made for services of any kind, its support being derived from an endowment fund and from private contributions. Patients are received without distinction as to race or locality of residence.

CARNEY HOSPITAL

The Carney Hospital, an unendowed institution, was opened on June 9, 1863, under the direction of the Sisters of Charity of St. Vincent de Paul, through the generosity of Andrew Carney of Boston. It is situated on the historic Dorchester Heights and commands a splendid view in every direction of Boston and its environs. Including general wards and private rooms it has about two hundred and fifty beds. Something over one-third of the patients pay nothing for the care they receive. There is also a large out-patient department.

It was the first hospital in New England to establish the continuous service of its staff members under a single chief; this was done in its surgical department in 1903. Dr. John C. Munro was the surgeon-in-chief. A little later the medical, gynecological and orthopedic departments were placed on a similar basis.

ST. ELIZABETH'S HOSPITAL

St. Elizabeth's Hospital, founded in 1868, was formerly located on West Brookline Street in the south end of Boston and in its early days was devoted exclusively to the care of women. In 1912 the demand for larger accommodations became imperative and a beautiful site for the new hospital was purchased on Nevins' Hill, Brighton.

Here a modern hospital with the latest equipment was built and its doors opened to the first patient on September 1, 1914.

The present building has a frontage of 230 feet with an east and a west wing, each 75 feet long, the three sides forming a court-yard. The building is four stories in front and three at the back with verandas on the three sides of the court. This court has a southern exposure, shielded from the icy northern blasts in winter and cooled by the gentle southern breezes in the summer.

A second building, containing the convent and chapel, is now in process of construction. The nurses are at present housed in an old mansion in the vicinity of the hospital and a home for them is to be built as soon as the convent is completed. This first building has accommodations for 200 patients, about 125 beds being in open wards, the remainder in private and semi-private rooms. There is also a ward for children.

The hospital is a diocesan hospital under the management of a board of trustees, of which His Eminence, Cardinal O'Connell, Archbishop of Boston, is pr sident. Acting under the board and in conjunction with it is a medical superintendent with Sisters of the Order of St. Francis at the head of the various departments.

Patients are received without regard to age, sex, creed, color or nationality. Those suffering from contagious, acute venereal or incurable diseases are not admitted.

All the services are continuous with the exception of the maternity, which has been found to work better as a rotating service. The various halls, five in number, are in charge of a Sister who is in every case a graduate nurse. The same is true of the operating suites, three in number. The training school connected with the hospital is under the supervision of a Sister, also a graduate nurse. The hospital has an out-patient department with daily clinics for the poor, also a weekly pre-natal clinic. The X-ray department is equipped with the most modern apparatus. The hospital possesses a motor ambulance which on account of the location in the out-skirts of the city is a most necessary adjunct for accidents and other emergency work.

The hospital is unendowed and is dependent for its support on the income derived from the private rooms together with the gifts of its many charitable friends.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

The hospital was incorporated March 12, 1863, the charter being granted to Marie Elizabeth Zakrzewska, M.D., Lucy Goddard, and Ednah D. Cheney, the avowed objects of the institution being (1) to provide for women medical aid of competent physicians of their own sex; (2) to assist educated women in the practical study of medicine; (3) to train nurses for the care of the sick.

The actual beginning of the hospital work on July 1, 1862, was in a small house on Pleasant Street. These quarters were soon outgrown, and in 1864 the hospital was removed to an estate on Warrenton Street, running through to Pleasant Street; this gave much better opportunity for isolating maternity cases, and more room for the dispensary, and here for the first time the surgical department became of importance.

Owing to the growth of the city, the downtown neighborhood became more noisy and uncomfortable, and the management felt that the full success of the hospital required a building especially designed for its purposes. The proceeds of a fair were therefore devoted to the purchase of a site for a building, which was chosen on high land in the old town of Roxbury, now a part of Boston. Here a new three-story building for medical and surgical patients was erected and opened in June, 1872; maternity patients being placed in a separate building of more temporary character.

By the purchase of surrounding land the hospital now owns a tract of nine acres. The original building on this site, now named the Zakrzewska Building, in honor of the founder of the hospital, is at present used for medical wards, X-ray, electrotherapeutic work, hydrotherapy, and for administrative purposes.

The Sewall Maternity was erected in 1891, and has since been enlarged to 48 beds.

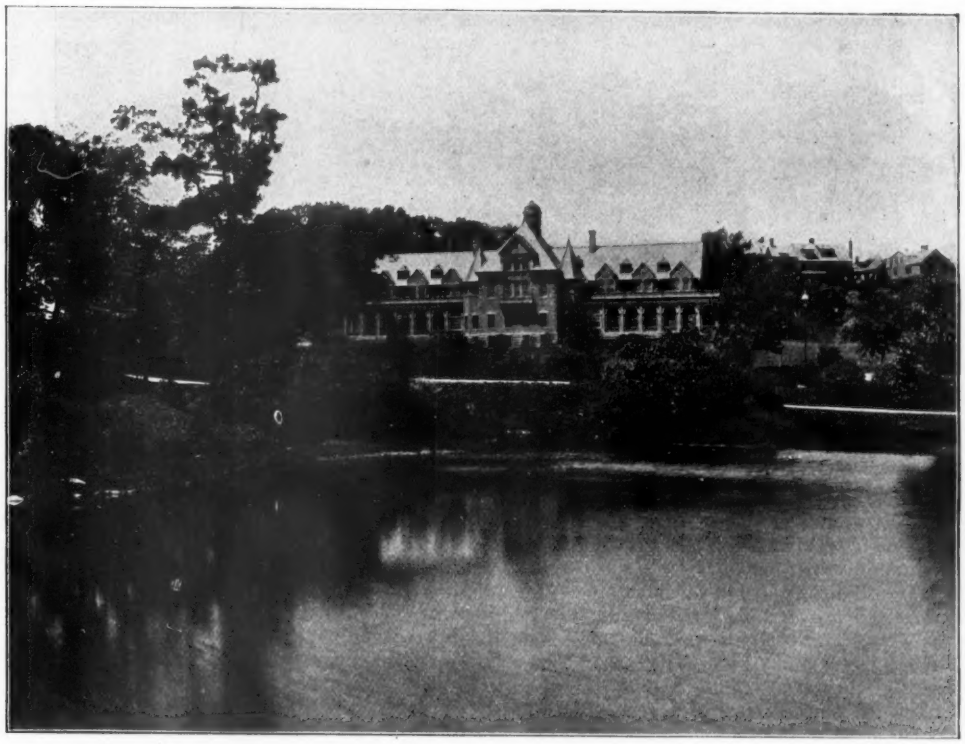
The Cheney Surgical Building was opened in 1900, the Goddard Home for Nurses in 1911, and the Kimball Cottage for Children, with its separate operating pavilion, the same year.

The hospital has now a capacity of 150 beds. Six women internes are appointed annually for a service of twelve months.

The dispensary has always remained in the heart of the city; its present quarters, the Pope Building, was erected in 1896 at 29 Fayette Street. There are medical, surgical and gynecological clinics, besides special clinics for eye, ear, nose and throat. Two of the internes are resident at the dispensary and attend medical and obstetrical patients in their own homes.

There is a Social Service Department connected with both hospital and dispensary.

Besides being unique in that it is the only



Free Hospital for Women

hospital in Boston where the staff is composed entirely of women, it has also the distinction of having opened a maternity department ten years prior to the founding of any other lying-in hospital in Boston. It also established the first training school for nurses in the United States.

One of the three avowed objects in founding the hospital was "to train nurses for the care of the sick." This was always kept in view from its origin in 1862. The experience of the Civil War did much to convince all classes of the importance of training for this profession as for every other. Before that time young women were averse to giving even six months to acquiring practical knowledge without pay. In 1872 the new building in Roxbury gave larger opportunities for the methodical organization of the training school, and the course was lengthened to one year, with a definite schedule of lectures. The period of training has been extended from time to time. Since 1901 it has been three years.

The work done by the different departments of the hospital has steadily increased. Statistics from the last annual report give a total of 1,250 admissions to the hospital: medical, 386; surgical, 264; maternity, 600; 13,564 cases were treated at the dispensary clinics, besides 3,902 visits on patients at their homes.

The private corporation of the hospital receives neither state nor city aid, but does a large proportion of charitable work from its own funds.

UNITED STATES NAVAL HOSPITAL

The United States Naval Hospital at Chelsea was established in 1836. The present main building, occupied in 1915, conforms to the "type" naval hospital plan, a design adapted with slight modification to subtropical stations as well as those in temperate zones.

The general arrangement of the main hospital resembles a "T," the central administration portion with the lateral wings forming the top, the subsistence and operating building, with con-

St. Elizabeth's Hospital

necting corridors and solaria, forming the vertical stem of the letter. The present capacity of the hospital is about 140 beds, and provision has been made for its extension to accommodate 400 beds should need arise.

The hospital is exclusively a naval institution, all connected with it being members of the naval organization, and all patients being officers or enlisted men of the navy. The work done is general in character being that naturally, entailed by the maintenance of a general hospital for men.

FORSYTH DENTAL INFIRMARY

The Forsyth Dental Infirmary for Children stands on the south side of the Back Bay Fens, near the Boston Art Museum. It is a handsome, new building, and aside from its practical utility, has a distinct value from an artistic point of view. The building is a memorial structure and therefore embodies many decorative features not usually found in purely hospital buildings.

The infirmary is an absolutely unique foundation. Small local dental clinics have existed in various parts of the world for some years, but this institution represents the first attempt on an adequate scale to care for the dental and oral needs of the children of a large urban population.

The building contains a large operating room in which there are 68 chairs, with room for more than 100; a boys' and a girls' ward, a museum and a research room, a room seating 200 persons in which popular lectures on oral and general hygiene are given, an operating theater, waiting rooms, children's room, etc. The sterilizing room contains ovens in which 60,000 instruments may be sterilized over night.

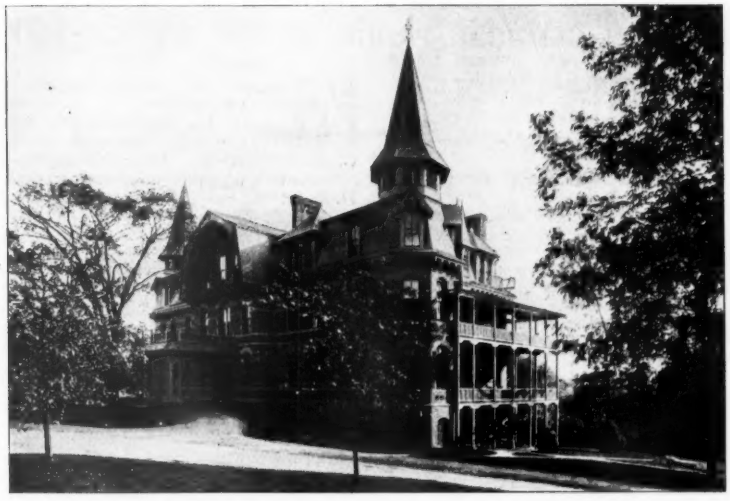
Every appointment of the building represents the last word in asepsis and efficiency. It is expected that the infirmary with its present equipments will care for 600 children per day. When the equipment is completed over 1,000 children per day can be accommodated.

ANGELL MEMORIAL HOSPITAL

The George T. Angell Memorial Hospital for animals, which was dedicated recently in Boston, is one of the best equipped institutions in the world for the care and treatment of animals. This new building, containing the business offices of the Massachusetts Society for the Prevention of Cruelty to Animals and the American Humane Education Society as well as spacious quarters for the medical and surgical treatment of animals, was started in the fall of 1913 and completed last spring. It is in every way thoroughly adapted to the purposes for which it was planned and constructed, and is in all respects a most fitting memorial to the life and labors of the great founder of the societies.

The building occupies 22,000 square feet of land situated in that section of the city that has already become famed for its hospitals, and educational and philanthropic institutions. The structure is fireproof throughout with concrete and tile floors, plaster block and brick partitions. The hospital proper is of two stories contituting two sides and the rear of the entire building and forming, with the front, a large open court which is protected by a glazed awning on three sides. The slate roof of the entire hospital affords ample exercise yards for small animals.

On the ground floor of the hospital there are operating-rooms, medical, surgical, and contagious



New England Hospital for Women and Children

wards, laboratory, tan-bark room, and garage. The operating-rooms and clinics have special metal window frames and sash to admit the most light possible and all wards have granolothic dado, five feet in height.

Many other features have been introduced into the hospital sections, including the latest type of tilting table for horse operations, and soak stalls supplied with hot and cold water passed through anti-scalding mixing valves.

The upper floor contains wards for the accommodation of smaller animals, a "small pet" department, hay and grain room, and superintendent's apartments.

The administration and editorial offices are located on the second floor of the main building, fronting on Longwood Avenue. Here also are the consulting-rooms, the library and memorial room, where are to be kept portraits of benefactors, tablets bearing their names and cabinets containing the names of every contributor to the fund for erecting and maintaining the building. The first floor contains the hospital offices and rooms for prosecuting agents and veterinarians.

With the single exception of the memorial room, in which are marble pilasters and marble floor, the interior is finished in wood, with no attempt at decoration. Indeed, the building throughout is entirely without "frills." Whether one views it from without or within, the impression is at once striking that this hospital and all its appointments were planned and carried out with an eye single to permanence and serviceability.

Since the opening of its doors to the admission of patients on March 1, 1915, the hospital shows a steady increase from week to week both in the number of in-patients and out-patients. The official figures for the first five weeks, which President Rowley states as "far exceeding our anticipations," were: Free dispensary cases treated, 294; hospital cases, 156, of which 91 required surgical operations. The statement for the month of April is as follows: Dispensary cases, 296; hospital cases, 120. The total number of animals treated for the first two months is reported as 767. To the uninformed and to those who were skeptical as to the benefits which would be derived for animals from the establishment of such an institution, this figure will be a surprise; it is indeed little short of a revelation.

The veterinary staff at the hospital have had notable success in their work on many animals since the hospital was opened. Numerous surgical operations have been performed upon subjects commonly regarded as passed the stage of curability and timely relief has been extended in scores of cases which, if unattended, could have resulted only in the most serious consequences.

PRELIMINARY CLINICAL PROGRAM FOR BOSTON MEETING

MASSACHUSETTS GENERAL HOSPITAL

Monday

C. A. PORTER — 9. Operations: Goiter, cancer of stomach.
D. F. JONES — 9. Operations: Cancer of rectum (first stage).
R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON — 10. Demonstration: Comparison of clinical evidence with post-mortem findings.
HUGH CABOT et al — 2. Operations: Epididymectomy for tuberculosis, litholapaxy for stone in bladder, ureterotomy for stone.
C. L. SCUDDER — 3. Demonstration: Fractures.
HUGH WILLIAMS — 3. Demonstration: Cases.

Tuesday

E. G. BRACKETT and R. B. OSGOOD — 9. Operations: Excision of knee, with bone plates, exploration of knee joint through median incision.
D. L. EDSALL — 10. Clinic: Border-line cases.
C. L. SCUDDER and H. F. HEWES — 10. Demonstration: Diagnosis and treatment of chronic gastric ulcer.
G. W. W. BREWSTER — 2. Operations: Hysterectomy for fibroids, appendectomy.
LINCOLN DAVIS — 2. Operations: Ureterotomy for stone, hysterectomy.
ROGER I. LEE and BETH VINCENT — 2. Demonstration: Splenectomy for pernicious anæmia.
C. C. SIMMONS — 3. Demonstration: Osteomyelitis.
G. A. LELAND, JR. — 3. Demonstration: Anthrax.

Wednesday

F. G. BALCH — 9. Operations: Prostatectomy, abdominal tumor.
R. B. GREENOUGH — 9. Operations: Benign tumor of breast, cancer of breast.
Z. B. ADAMS, M. S. DANFORTH, and C. H. BUCHOLZ — 10. Demonstration: Scoliosis.
L. T. BROWN — 10. Demonstration: Postural defects.
FARRAR COBB — 2. Operations: Hysterectomy for cancer (Wertheim).
HUGH WILLIAMS — 2. Operations: Gall-bladder.
R. C. CABOT, HUGH CABOT, and OSCAR RICHARDSON — 3. Demonstration: Comparison of clinical evidence with post-mortem findings.

Thursday

HUGH CABOT et al — 9. Operations: Nephrectomy for tuberculosis, pyelotomy for stone, prostatectomy.
R. C. CABOT — 10. Clinic: Border-line cases.
ABNER POST — 10. Demonstration: Congenital syphilis.
E. G. BRACKETT and R. B. OSGOOD—2. Operations: Open operation on hip, gig-saw osteotomy of knee joint.
C. A. PORTER, A. K. STONE, H. F. HEWES, and J. B. HARTWELL — 3. Demonstration: Tuberculous cervical adenitis.
W. J. MIXTER — 3. Demonstration: Fracture of the skull.

Friday

C. L. SCUDDER — 9. Operations: Duodenal ulcer, cancer of stomach, fracture of femur.
R. B. GREENOUGH — 9. Operations; Cancer of jaw, tongue, or lip.
J. C. WARREN — 10. Demonstrations: Reminiscences of the discovery of ether.
C. A. PORTER — 10. Demonstration: Cases.
R. H. MILLER — 10. Demonstration: Tetanus.
C. A. PORTER — 2. Operations: Tuberculous cervical adenitis, operation on peripheral nerve.
D. F. JONES — 2. Operations: Cancer of rectum (second stage).

Surgical Specialities

A. COOLIDGE, J. P. CLARK, H. P. MOSHER, D. C. GREENE, W. F. KNOWLES, H. A. BARNES, C. ROBBINS, and F. E. GARLAND — Eye, ear, nose, and throat clinics, daily.
G. H. WRIGHT — Demonstrations in oral surgery.
J. L. GOODALE — Demonstration: The diagnosis and desensitizing of hay fever.

BOSTON CITY HOSPITAL

Monday

J. B. BLAKE, W. E. FAULKNER, and D. D. SCANNELL — 9. Operations: Surgical.
E. B. YOUNG and N. R. MASON — 9. Operations: Gynecological.
DRS. HOLMES, BORDEN, COFFIN, and assistants — 10. Ear, nose and throat clinic.
H. A. LOTHROP, F. J. COTTON, and L. R. G. CRANDON — 2. Operations: Surgical.
G. P. SANBORN — 3. Demonstration: End results in the tuberculin treatment of lymphnodular tuberculosis.
F. W. WHITE, F. B. LUND, and R. D. LEONARD — 4. Demonstration: Diagnosis and treatment of ulcer and cancer of the stomach (medical, surgical, and X-ray).

Tuesday

F. B. LUND, J. C. HUBBARD, and HORACE BINNEY — 9. Operations: Surgical.
E. B. YOUNG and N. R. MASON — 9. Operations: Gynecological.
DRS. HOLMES, BORDEN, COFFIN, and assistants — 10. Ear, nose and throat clinic.
PAUL THORNDIKE and assistants — 2. Operations: Genito-urinary.
PAUL THORNDIKE — 3. Demonstration: Prostatectomy, renal calculus.
HORACE BINNEY — 4. Demonstration: Treatment of tumors of the bladder with the high frequency current.

Wednesday

E. H. NICHOLS, W. C. HOWE, and H. B. LODER — 9. Operations: Surgical.
E. B. YOUNG and N. R. MASON — 9. Operations: Gynecological.
DRS. HOLMES, BORDEN, COFFIN, and assistants — 10. Ear, nose and throat clinic.
J. B. BLAKE, W. E. FAULKNER, and D. D. SCANNELL — 2. Operations: Surgical.
J. B. BLAKE — 3. Demonstration: Splenectomy for Banti's disease.
A. R. KIMPTON — 4. Demonstration: Transfusion by the use of glass cylinders; bone tumors; resection of the stomach for sarcoma.

Thursday

H. A. LOTHROP, F. J. COTTON, and L. R. G. CRANDON — 9. Operations: Surgical.

E. B. YOUNG and N. R. MASON — 9. Operations: Gynecological.

DRS. HOLMES, BORDEN, COFFIN, and assistants — 10. Ear, nose and throat clinic.

F. B. LUND, J. C. HUBBARD, and HORACE BINNEY — 2. Operations: Surgical.

F. J. COTTON — 3. Demonstration: Artificial impactions in fracture of the hip; joint affections; separations of the lower epiphysis of the femur.

F. B. LUND — 4. Demonstration: Results of operative treatment of fractures, particularly with Parham and Martin bands; congenital cystic kidney; results of operations for intestinal tuberculosis.

C. R. C. BORDEN — 4. Demonstration: Cancer of the œsophagus, œsophagoscopy.

J. H. CUNNINGHAM — 4:30. Demonstration: Nephrectomy for acute unilateral hæmatogenous infections of the kidney.

F. H. LAHEY — 5. Demonstration: Cardiospasm; carcinoma of the jejunum; resection of the rectum with perineal anus.

Friday

PAUL THORNDIKE and assistants — 9. Operations: Genito-urinary.

E. B. YOUNG and N. R. MASON — 9. Operations: Gynecological.

DRS. HOLMES, BORDEN, COFFIN, and assistants — 10. Ear, nose and throat clinic.

E. H. NICHOLS, W. C. HOWE, and H. B. LODER — 2. Operations: Surgical.

E. H. NICHOLS — 3. Demonstration: Results and methods of operating for osteomyelitis; cerebral surgery.

H. A. LOTHROP — 4. Demonstration: A new operation on the frontal sinus.

J. C. HUBBARD — 5. Demonstration; Sarcoma of the femur; excision of the transverse colon; perforation of duodenal ulcer; transduodenal removal of a gallstone; rupture of the liver.

In connection with the operative clinics, demonstration of special methods of anæsthesia — intratracheal, spinal, etc. — will be given, where possible, by J. E. BUTLER, F. L. RICHARDSON, and N. N. MORSE.

CHILDREN'S HOSPITAL

Orthopedic Department

R. W. LOVETT, A. THORNDIKE, ROBERT SOUTTER, A. EHRENFRIED, A. T. LEGG, J. W. SEVER, and HENRY J. FITZSIMMONS — Daily, 9 to 11. Orthopedic operations: Reduction of congenital dislocation of the hip by various methods, and especially by a special machine; tendon transplantations, capsule reefing, etc., in infantile paralysis, the use of silk ligaments in infantile paralysis; the operative correction of club foot; the Hibbs and Albee operations for tuberculosis of the spine; the operative treatment for spastic paralysis; operations for coxa vara; bone transplantations.

R. W. LOVETT — Monday, 2:30 and 5:10. Demonstration: The treatment of infantile paralysis by muscle training, with exhibition of patients. The treatment of scoliosis by forcible jackets. Application of jackets and demonstration of results.

ROBERT SOUTTER and A. T. LEGG — Monday, 3:15. Demonstration: Exhibition of the results of the operative treatment of infantile paralysis.

E. G. MARTIN — Monday, 3:30. Demonstration: An apparatus to determine the strength of muscles affected by infantile paralysis, with conclusions to be drawn from observations made by it.

J. J. THOMAS and J. W. SEVER — Monday, 4. Demonstration: Obstetrical paralysis and fracture of the acromion process simulating it.
Monday, Tuesday, and Wednesday, 3. Demonstration: Treatment of paralysis by muscle training.

A. THORNDIKE — Monday, 4:30. Demonstration: End-results in osteoplastic operation for spinal tuberculosis.

PERCY BROWN — Monday, 4:50. Demonstration: Röntgen results in osteoplastic spinal operations.
Thursday, 4. Demonstration: Result of röntgen investigation in cases of fibrous stenosis of the pylorus in children.
Daily, 10 to 4. Exhibition of röntgenograms, röntgen department.

ROBERT SOUTTER — Thursday, 3. Operation: A new operation for flexion contraction of the thigh in infantile paralysis.

A. T. LEGG — Thursday, 3:30. Operation: Transplantation of the origin of the pectoralis major muscle in paralysis of the shoulder.

A. EHRENFRIED — Thursday, 2:30. Demonstration: Multiple enchondroma.

H. J. FITZSIMMONS — Monday, Tuesday, and Wednesday, 3. Demonstration: Treatment of scoliosis with methods in use; cases and records.
Thursday, 4:20. Demonstration: Apparatus for reduction of congenital hip dislocations.

PROFS. ERNST, FOLIN, HUNT, CANNON, and WOLBACH, DRS. STONE and MORSE — Thursday, 4:30. Clinic: Infantile paralysis.

Visit to orthopedic wards daily, 11 to 12. The new hospital buildings will be open to inspection by visitors daily, 9 to 10.

Surgical Department

J. S. STONE, W. E. LADD, C. G. MIXTER, and T. W. HARMER — Daily, 11 to 1. Surgical operations: Harelip, cleft palate, empyema, hernia, cervical adenitis, webbed fingers, hypospadias, undescended testis, etc.

C. G. MIXTER — Tuesday, 2:30. Demonstration: Imperfect and ectopic anus.
Wednesday, 2:30. Demonstration: Tuberculous peritonitis; pyloric stenosis; undescended testis.

W. E. LADD — Tuesday, 2:30. Demonstration. Cervical adenitis.
Wednesday, 2:30. Demonstration: Intussusception; harelip and cleft palate.

J. S. STONE, W. E. LADD, and J. J. THOMAS — Tuesday, 2:30. Demonstration: Fractures in children, subperiosteal and epiphyseal, elbow-joint fractures, Volkman's ischæmic contractures.

J. S. STONE — Wednesday, 2:30. Demonstration: Some obscure abdominal conditions; empyema, harelip, and cleft palate, acute epiphyseal lesions.

T. W. HARMER — Wednesday, 2:30. Demonstration: The treatment of birthmarks.

PROFS. ERNST, FOLIN, HUNT, CANNON, WOLBACH, DRS. LOVETT, STONE, and MORSE — Tuesday, 4:30. Clinic: Cervical adenitis.

D. CROSBY GREENE and F. E. GARLAND — Monday, Wednesday, and Friday, 3. Nose and throat clinic.

Visit to general surgical wards daily, 10 to 11.

MASSACHUSETTS HOMŒOPATHIC HOSPITAL

Monday

A. G. HOWARD and H. MOORE — 9. Orthopedic operations: Bone grafting, tendon transplantation.

J. H. PAYNE and D. W. WELLS — 9. Eye operations: Advancement, pulley stitch; advancement, modified Worth; ptosis, Tansley operations; trephining, glaucoma.

DRS. RICE, HOUGHTON, and C. SMITH — 2. Operations: Nose and throat.

W. F. WESSELHOEFT and T. E. CHANDLER — 2. General surgical operations: Gastric ulcer, ventral hernia, inguinal hernia, appendicitis, œsophageal diverticulum.

Tuesday

J. E. BRIGGS and C. T. HOWARD — 9. General surgical operations: Prostate, appendix, goiter, inguinal hernia.

G. A. SUFFA and A. W. HORR — 9. Eye operations: Muscle tucking; advancement, modified Worth; cataract extraction; glaucoma.

HORACE PACKARD and C. T. HOWARD — 2. General surgical operation: Appendectomy, a simpler method of sealing the appendicular stump. Demonstration cases: Prostatectomy, the choice of routes; the control of post-operative hæmorrhage, illustrative operations; empyema, cases for demonstration; enteroptosis, cholelithiasis.

DRS. RICE, HOUGHTON, and SMITH — 2. Operations: Nose and throat.

Wednesday

DRS. RICE, HOUGHTON, JOHNSON, SMITH, and BUSH — 9. Operations: Nose and throat.

GEORGE H. EARL and H. MOORE — 9. Orthopedic operations: Congenital dislocation of the hip, bone-grafting, tendon transplantation.

W. F. WESSELHOEFT and R. C. WIGGIN — 2. General surgical operations: Nephrolithiasis.

F. W. COLBURN — 2. Operations: Ear.

Thursday

J. E. BRIGGS and C. CRANE — 9. General surgical operations: Cancer of the breast, appendix, cholelithiasis, nephrolithiasis.

DRS. RICE, HOUGHTON, and C. SMITH — 9. Operations: Nose and throat.

G. R. SOUTHWICK — 2. Gynecological operations: Ovarian cystomata, retrodisplacement of uterus, uterine fibromata, perineorrhaphy.

Friday

G. R. SOUTHWICK and D. G. WILCOX — 9. Gynecological operations.

DRS. A. S. BRIGGS, BOYD, LEE, SEDGELEY, SOUTHER, and THOMAS — 2. General surgical operations.

Demonstrations

W. H. WATTERS — Surgical pathology.

G. A. SUFFA — Ophthalmotrope.

Routine examination of antepartem cases — Wednesday, 10.

Social service clinic for post-partem cases — Thursday, 2.

Daily clinics in twilight sleep.

Daily exhibition of new maternity building.

PETER BENT BRIGHAM HOSPITAL

HARVEY CUSHING — Daily. Clinics or demonstrations: Surgery of the brain, pituitary body, spinal cord, peripheral nerves.

DAVID CHEEVER and JOHN HOMANS — Daily. Operations: Surgical.

HENRY A. CHRISTIAN, CHANNING FROTHINGHAM, and others of the medical staff will coöperate in giving clinics or demonstrations on selected topics, such as the electrocardiogram, etc.

FREE HOSPITAL FOR WOMEN

DRS. GRAVES, PEMBERTON, WADSWORTH, HUTCHINS, and BAKER — Tuesday, Wednesday, and Thursday, 9. Operations: Gynecological.

W. P. GRAVES — Tuesday, 2:30. Exhibit of drawings illustrating gynecological subjects.

DR. PEMBERTON — Wednesday, 2:30. Cystoscopic demonstration.

DR. HUTCHINS — Thursday, 2:30. Demonstrations: Laboratory specimens.

ST. ELIZABETH'S HOSPITAL

DRS. LANE and SUPPLE — Monday and Thursday, 9. Operations.

DR. M. J. CRONIN — Monday, Thursday, and Friday, 10. Ward visit.
Wednesday, 9. Intravenous salvarsan injections.

DR. T. F. BRODERICK — Tuesday, 9. Orthopedic operations and clinic.

DR. A. L. CHUTE — Wednesday and Friday, 9. Operations: Genito-urinary.

DRS. BRAINERD and HOLMES — Tuesday, 9. Nose and throat clinic.

DR. A. F. DOWNING — Monday and Friday, 11. Demonstrations: Laboratory technique.

DR. P. F. BUTLER — Tuesday and Thursday, 10. Demonstration: Radiography.

DRS. MCDONALD and MCADAMS — Wednesday, 10. Eye clinic.

The history, diagnosis, and indication for operation in each case will be discussed previous to operation by Dr. Cronin of the medical service and Dr. Butler of the röntgenological department.

ROBERT BRIGHAM HOSPITAL

CHARLES F. PAINTER and LLOYD T. BROWN — Tuesday, 10. Operations: Surgical.

EDWARD RICHARDSON and RICHARD MILLER — Thursday, 10. Operations: Surgical.

DRS. SPEARE, LAWRENCE, BROWN, and PAINTER — Monday, Wednesday, and Friday, 3. Clinics: Surgery of chronic diseases, arthritis, intestinal tuberculosis, peritoneal adhesions, hæmolytic diseases.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

MARY A. SMITH — Monday and Thursday, 10. Operations: Gynecological.

ELIZABETH T. GRAY and LETITIA D. ADAMS — Monday, 2, Tuesday, 10. Operations: Gynecological.

EMMA B. CULBERTSON — Tuesday and Friday, 2. Operations: Gynecological.

FLORENCE DUCKERING and LETITIA D. ADAMS — Wednesday, 10; Thursday, 2. Operations: Gynecological.
MARGARET NOYES — Wednesday, 2. Ear, nose, and throat clinic.
MAUDE CARVILL — Thursday, 2. Eye clinic.
ISABELLE D. KERR — Friday, 10. Ear, nose, and throat clinic.

Scopolamine-morphia anæsthesia both with and without ether will be used during these clinics. Statistics, covering six years' continuous use of this form of surgical anæsthesia, on over 1,400 cases, are available.

LONG ISLAND HOSPITAL

F. H. LAHEY — Monday, 2. Operations.
J. H. CUNNINGHAM — Tuesday and Wednesday, 2. Operations.
ROBERT SOUTTER — Thursday and Friday, 2. Operations.

CARNEY HOSPITAL

J. T. BOTTOMLEY and D. F. MAHONEY — Monday, Wednesday, and Friday, 9. Operations: Surgical.
W. R. MACAUSLAND and A. R. MACAUSLAND — Monday, Wednesday, and Friday, 9. Operations: Orthopedic.
F. W. JOHNSON and S. RUSHMORE — Tuesday and Thursday, 9. Operations: Gynecological.

CODMAN HOSPITAL

Hospital will be open daily for inspection with exhibition of the End-Result System. From 3 to 5 each afternoon. DR. EMORY A. CODMAN will explain in detail the important points of this system.

HOUSE OF THE GOOD SAMARITAN

DRS. SOUTTER, LEGG, and SEVER — Monday, Wednesday, and Friday, 10. Clinics: Infantile paralysis, muscle transplantation, flattened condition of the head of the femur, obstetrical paralysis.

TUFTS MEDICAL SCHOOL

A. W. GEORGE — Daily, 2 to 5. Demonstrations: Röntgenology (at 43 Bay State Road).

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

DRS. CROCKETT, MOSHER, and EMERSON — Monday and Friday. Otological clinic.
DRS. JACK, WALKER, POWERS, and BLODGETT — Tuesday. Otological clinic.
DRS. HAMMOND, WHITE, and FAUNCE — Wednesday. Otological clinic.
DRS. JACK, KNOWLES, TOBEY, and BOGAN — Thursday. Otological clinic.
DRS. THOMPSON, MORSE, and assistants — Monday and Tuesday. Opthalmological clinics.
DRS. HASKELL, SPAULDING, and assistants — Wednesday. Opthalmological clinics.
DRS. VERHOEFF, DERBY, and assistants — Thursday and Friday. Opthalmological clinics.

HUNTINGTON MEMORIAL HOSPITAL

R. B. GREENOUGH and WILLIAM DOANE — Tuesday and Friday, 3. Demonstration of cancer cases treated with radium and X-ray.

INFANTS' HOSPITAL

BETH VINCENT — Thursday, 10. Operations and demonstration of cases.
CHARLES HUNTER DUNNE — Thursday, 10. Clinical demonstration of infants' diseases having a surgical bearing.

BOSTON DISPENSARY

H. M. CHASE and H. F. DAY — Surgical clinic.
JOHN ADAMS — Orthopedic clinic.
HENRY J. PERRY and ARTHUR H. CROSBY — Genito-urinary clinic.

FORSYTH DENTAL INFIRMARY

FRED B. LUND — Monday, 9. Surgical operations.
HARRY H. GERMAIN — Tuesday, 9. Surgical operations.
HUGH CABOT — Wednesday, 9. Surgical operations.
HUGH WILLIAMS — Thursday, 9. Surgical operations.
WILLIAM E. CHENERY and LOUIS ARKIN — Daily, 10. Nose and throat clinic.
L. M. S. MINER — Wednesday, 2. Oral surgery.
HARRY B. SHUMAN — Tuesday, 2. Oral surgery.
ALBERT L. MIDGLEY — Monday, 2. Oral surgery.
DR. STROUT — Thursday, 2. Oral Surgery.
ALBERT KINLEY, JR.— Daily, 11. Radiography.
WILLIAM A. GOBIE — Daily, 11:30 and 3. Extracting clinic.
WILLIAM Z. HILL — Daily, 10 and 4. Operative dental clinics.
FRANK A. DELABARRE — Daily, 9. Orthodontia clinic.

Research Laboratory will be open from 9 to 12 and 2 to 4 daily. Exhibition of pathological and bacteriological specimens.

HARVARD MEDICAL SCHOOL

PROFS. COUNCILMAN and MALLORY — Demonstration: Pathology.
PROFS. CANNON and W. T. PORTER — Demonstration: Physiology.
PROF. FOLIN — Demonstration: Chemistry.
PROF. STRONG — Demonstration: Tropical Medicine.
PROF. REID HUNT — Demonstration: Pharmacology.
DRS. ORDWAY and TYZZER — Demonstration: Cancer research.
JOHN WARREN — Demonstration: Anatomy.
W. F. WHITNEY — Demonstration: Warren anatomical museum.
F. T. LEWIS — Demonstration: Embryology.
J. E. GOLDTHWAIT — Demonstration: Visceroptosis.

Fig. 3. Posterior surface of the uterus, showing hæmorrhagic infiltration of uterus and ovary.
(*J. Whitridge Williams.*)